INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE ENGINEERING**				
Course Title	**LINEAR ALGEBRA AND CALCULUS**				
Course Code	AHSC02				
Program	B.Tech				
Semester	I				
Course Type	Foundation				
Regulation	UG - 20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Mr. P Shantan Kumar, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
10+2	-	-	Basic Principles of Algebra and Calculus

II COURSE OVERVIEW:

The Linear algebra is a sub-field of mathematics concerned with vectors, matrices, and linear transforms. Calculus is the branch of mathematics which majorly deals with derivatives and integrals. Linear algebra is a key foundation to the field of machine learning. The course includes types of Matrices, Rank, methods of finding rank, Eigen values and Eigen vectors, maxima and minima of functions of several variables, solutions of higher order ordinary differential equations and Fourier series. Matrices are used in computer animations, color image processing. Eigen values are used by engineers to discover new and better designs for the future. The laws of physics are generally written down as differential equations. So, differential equations and Fourier series expansions have wide applications in various engineering and science disciplines. This course enables the students to gain basic knowledge on the mathematics which is used in modeling the real time engineering problems very often.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Linear Algebra and Calculus	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Table 1: The expected percentage of cognitive level of questions in SEE.

10 %	Remember
30 %	Understand
60 %	Apply
0 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

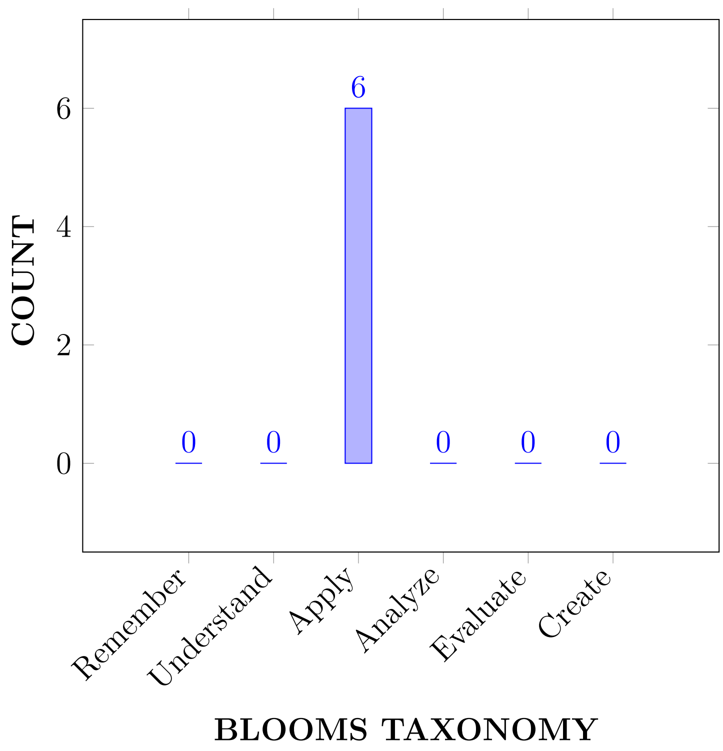
I	The principles of Eigen value analysis and linear transformations, Matrix rank finding methods.
II	The calculus of functions of several variables and the concept of maxima-minima for a three-dimensional surface.
III	The analytical methods for solving higher order differential equations with constant coefficients.
IV	Fourier series expansions in standard intervals as well as arbitrary intervals.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Compute** the rank and inverse of real and complex matrices with elementary transformation methods.	Apply
CO 2	**Use** the Eigen values, Eigen vectors for developing modal and Spectral matrices from the given matrix..	Apply
CO 3	**Make use of** Cayley Hamilton theorem for finding positive and negative powers of the matrix.	Apply
CO 4	**Utilize** the mean–value theorems and partial derivatives in estimating the extreme values for functions of several variables	Apply
CO 5	**Solve** the Second and higher order linear differential equations with constant coefficients by using substitution and method of variation of parameters..	Apply
CO 6	**Apply** the Fourier Series expansion of periodic, even and odd functions in analyzing the square wave, sine wave rectifiers.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Program Outcomes	
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	-	-
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 5	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	✓	✓	-	-	-	-	-	-	-	-	-		-	-	-

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	**Explain** the role of rank and inverse of real and complex matrices in solving **complex engineering problems** by using elementary transformation methods **(principles of mathematics).**	2
CO 2	PO 1	**Determine** the Eigen values, Eigen vectors, Spectral matrix **complex engineering problems modeled by matrices** with help of Characterstic Equation **(principles of mathematics).**	2
	PO 2	**Model** the problem into matrices, prepare precise **statement** of the problem and apply the concepts of Eigen values and Eigen vectors to **develop the solution** and **interpret, validate** the results through proper **documentation**	6
CO 3	PO 1	**Make use of** Cayley Hamilton theorem for finding positive and negative powers of the matrix and apply them in the **complex engineering problems** modeled by matrices **(principles of mathematics).**	2
CO 4	PO 1	**Explain** the mean–value theorems for the single variable functions andthe extreme values for functions of several variables apply them in the **complex engineering problems** Ordinary and Partial derivatives .	2
CO 5	PO 1	**Determine**the solution of **complex engineering problems** modeled by Second and higher order linear differential equations with constant coefficients by using substitution method and method of variation of parameters.	2

	PO 2	**Model** the problem with the help of ordinary differential equations, prepare precise **statement** of the problem and apply method of variation of parameters and other analytical methods to **develop the solution** and **interpret, validate** the results through proper **documentation**	6
CO 6	PO 1	**Build** the Fourier series expansion **for the complex engineering problems** modeled by given periodic, even and odd functions in various intervals with the help of Fourier coefficients formulae **(principles of mathematics).**	2
	PO 2	**Model** the problem with the help of suitable periodic functions, prepare precise **statement** of the problem and apply Fourier series expansions to **develop the solution** and **interpret, validate** the results through proper **documentation**	6

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	Program Outcomes/No.of Key Competencies Matched												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	67	60	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	67	60	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	67	60	-	-	-	-	-	-	-	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.
0 - $0\% \leq C \leq 5\%$ – No correlation
1 - $5\% < C \leq 40\%$ – Low/ Slight
2 - $40\ \% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE	PROGRAM OUTCOMES												PSO'S		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	18	9	-	-	-	-	-	-	-	-	-	-	-	-	-
AVERAGE	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Assign-ments	-	Seminars	-
Labora-tory Practices	-	Student Viva	-	Mini Project	-	Certifica-tion	-
Term Paper	-	Tech - talk	✓	Concept Video	PO 1, PO 2	-	-

XVII ASSESSMENT METHODOLOGY-INDIRECT:

x	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**THEORY OF MATRICES**
	Real matrices: Symmetric, Skew-Symmetric and Orthogonal matrices; Complex matrices: Hermitian, Skew- Hermitian and Unitary matrices; Elementary row and column transformations, finding rank of a matrix by reducing to Echelon form and Normal form; Finding the inverse of a matrix using Gauss-Jordan method
MODULE II	**LINEAR TRANSFORMATIONS**

	Cayley-Hamilton theorem: Statement, verification, finding inverse and powers of a matrix; Linear dependence and independence of vectors; Linear transformation; Eigen values and Eigen vectors of a matrix; Diagonalization of matrix.
MODULE III	**FUNCTIONS OF SINGLE AND SEVERAL VARIABLES**
	Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem-without proof; Functions of several variables: Partial differentiation, Jacobian, functional dependence, maxima and minima of functions with two variables and three variables. Method of Lagrange multipliers.
MODULE IV	**HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS**
	Linear differential equations of second and higher order with constant coefficients. Non-homogeneous term of the type f(x) = e^{ax} , sinax , cosax , x^n , e^{ax}v(x) and Method of variation of parameters.
MODULE V	**FOURIER SERIES**
	Fourier expansion of periodic function in a given interval of length 2π; Fourier series of even and odd functions; Fourier series in an arbitrary interval;

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36^{th} Edition, 2010
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint 2010.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, Linear Algebra: A Modern Introduction, 2^{nd} Edition, Brooks/Cole, 2005.

WEB REFERENCES:

1. https://nptel.ac.in/courses/111/108/111108157/

COURSE WEB PAGE:

1. lms.iare.ac.in

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Outcome based education	-	-
CONTENT DELIVERY (THEORY)			
2	Theory of Matrices: Types of Real Matrices	CO 1	T2:32.1 R1:4.1
3	Real Matrices: Symmetric, Skew-Symmetric Matrices	CO 1	T2:32.1 R1:4.2
4	Real Matrices: Orthogonal Matrices	CO 1	T2:32.1 R1:4.3
5	Complex Matrices: Hermitian, Skew- Hermitian	CO 1	T2:32.1 R1:4.3
6	Complex Matrices: Unitary Matrices	CO 1	T2:32.5 R1:4.6
7	Elementary Operations: Elementary Row and Column Transformations	CO 1	T2:32.5 R1:4.6
8	Rank of a Matrix by Echelon Form	CO 1	T2:32.4 R1:4.5
9	Rank of a Matrix by Normal Form	CO 1	T2:32.7 R1:4.8
10	Inverse of a Matrix by Gauss-Jordan Method	CO 1	T2-7.1 R1:7.4
11	Eigen Values of a Matrix	CO 2	T2-7.1 R1:7.4
12	Eigen Vectors of a Matrix	CO 2	T2-7.1 R1:7.4
13	Diagonalization of Matrix by Linear Transformation.	CO 2	T2:7.1 R1:7.4
14	Cayley-Hamilton Theorem- Statement, Verification	CO 3	T2:7.1 R1:7.4
15	Applications of Cayley – Hamilton: Finding Inverse and Powers of a Matrix	CO 3	T3-2.9 R1:2.1
16	Linear Dependence and Independence of Vectors	CO 2	T3-2.5 R1:2.8
17	Mean Value Theorems:1: Rolle's Theorem	CO 4	T3-2.5 R1:2.8
18	Mean Value Theorems:2: Lagrange's Theorem	CO 4	T3-2.5 R1:2.8

19	Mean Value Theorems:3: Cauchy's Theorem	CO 4	T3-2.5 R1:2.8
20	Functions of Several Variables: Partial Differentiation	CO 4	T3-2.5 R1:2.8
21	Jacobian Transformations	CO 4	T3-2.61 R1:2.10
22	Functional Dependence	CO 4	T1-7.1 R2:7.5
23	Maxima and Minima of Functions with Two Variables	CO 4	T3-2.61 R1:2.10
24	Maxima and Minima of Functions with Three Variables	CO 4	T1-7.1 R2:7.6
25	Application Method of Lagrange Multipliers	CO 4	T1-7.1 R2:7.7
26	Method of Lagrange Multipliers	CO 4	T3-2.5 R1:2.8
27	Linear Differential Equations of Second and Higher Order with Constant Coefficients	CO 5	T3-2.5 R1:2.8
28	Linear Differential Equations of Second and Higher Order with Constant Coefficients	CO 5	T3-2.5 R1:2.8
29	Non-Homogeneous term of the type F (X) = e^{ax}	CO 5	T3-2.5 R1:2.8
30	Non-Homogeneous term of the type F (X) = Sinax , Cosax	CO 5	T2-7.1 R1:7.4
31	Non-Homogeneous term of the type F (X) = X^n	CO 5	T2:7.1 R1:7.4
32	Non-Homogeneous term of the type F (X) = e^{ax}v(X)	CO 5	T2:7.1 R1:7.4
33	Method of Variation of Parameters	CO 5	T3-2.9 R1:2.1
34	Fourier Expansion of Periodic Function in a Given Interval of Length 2π	CO 6	T3-2.5 R1:2.8
35	Fourier Expansion of Periodic Function in a Given Interval of Length (-π,π)	CO 6	T3-2.5 R1:2.8
36	Fourier Series of Even Functions in a Given Interval of Length (-π,π)	CO 6	T2:7.1 R1:7.4
37	Fourier Series of Odd Functions in a Given Interval of Length (-π,π)	CO 6	T3-2.9 R1:2.1
38	Fourier Series in an Arbitrary Interval (0,2l)	CO 6	T3-2.5 R1:2.8
39	Fourier Series in an Arbitrary Interval (-l,l)	CO 6	T2:7.1 R1:7.4
40	Half- Range Fourier Sine Expansions in a Given Interval of Length (0,π)	CO 6	T3-2.9 R1:2.1

41	Half- Range Fourier Cosine Expansions in a Given Interval of Length (0,π)	CO 6	T3-2.5 R1:2.8
PROBLEM SOLVING/ CASE STUDIES			
42	Rank of the Matrix by Echelon and Normal Form	CO 1	T2:32.1 R1:4.2
43	Eigen Values and Eigen Vectors of The Matrix	CO 2	T2:32.1 R1:4.3
44	Finding Powers of the Matrix by Cayley Hamilton Theorem	CO 3	T2:32.1 R1:4.3
45	Finding Spectral Matrix by Linear Transformation.	CO 2	T2-7.1 R1:7.4
46	Jacobian Transformation in Cartesian and Polar Forms	CO 4	T2-7.1 R1:7.4
47	Finding Functional Relationship.	CO 4	T2:7.1 R1:7.4
48	Finding Critical Points.	CO 4	T2:7.1 R1:7.4
49	Solving Non-Homogeneous Differential Equations.	CO 5	T3-2.5 R1:2.8
50	Solving Second Order Non-Homogeneous Differential Equations by Method of Variation of Parameters.	CO 5	T3-2.5 R1:2.8
51	Finding Fourier Series	CO 6	T3-2.5 R1:2.8
52	Fourier Expansion of Periodic Function in a Given Interval of Length 2π	CO 6	T3-2.5 R1:2.8
53	Fourier Expansion of Periodic Function in a Given Interval of Length (-π,π)	CO 6	T3-2.61 R1:2.10
54	Fourier Series in An Arbitrary Interval (-l,l)	CO 6	T2:7.1 R1:7.4
55	Finding Fourier Sine Series in Interval (0,l)	CO 6	T3-2.9 R1:2.1
56	Finding Fourier Cosine Series in Interval (0,l)	CO 6	T3-2.5 R1:2.8
DISCUSSION OF DEFINITION AND TERMINOLOGY			
57	Real, Complex Matrices and Rank of a Matrix	CO 1	T3-2.5 R1:2.8
58	Eigen Values and Eigen Vectors, Diagonalization	CO 2,C0 3	T3-2.5 R1:2.8
59	Mean Value Theorems, Jacobian Transformations, Functionally Dependent and Independent	CO 4	T3-2.5 R1:2.8
60	Higher Order Differential Equations	CO 5	T3-2.5 R1:2.8
61	Fourier Series (Even, Odd, Neither Functions)	CO 6	T3-2.61 R1:2.10

DISCUSSION OF QUESTION BANK			
62	Theory of Matrices	CO 1	T2:7.1 R1:7.4
63	Linear Transformations	CO 2,C0 3	T3-2.9 R1:2.1
64	Functions of Several Variables	CO 4	T3-2.5 R1:2.8
65	Higher Order Differential Equations	CO 5	T2:32.1 R1:4.3
66	Fourier Series.	CO 6	T2-7.1 R1:7.4

Signature of Course Coordinator **HOD, CSE**
Mr. P Shantan Kumar, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Course Title	**CHEMISTRY**				
Course Code	AHSC06				
Program	B.Tech				
Semester	I	CSE			
Course Type	FOUNDATION				
Regulation	IARE - UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	2	-	2	-	-
Course Coordinator	Dr V N S R Venkateswararao, Associate Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
10+2	-	-	Basic Principles of chemistry

II COURSE OVERVIEW:

The course discusses elements and compounds and their applied industrial applications. It deals with topics such as batteries, corrosion and control of metallic materials, water and its treatment for different purposes, engineering materials such as plastics, elastomers and biodegradable polymers, their preparation, properties and applications, energy sources and environmental science. Sustainable chemistry that focuses on the design of the products and processes that minimize or eliminate the use and generation of hazardous substances is also included.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Chemistry	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	x	Assignments	x	MOOCs
x	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
50%	Understand
50%	Apply
0%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

<table>
<tr><th colspan="2">Component</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td rowspan="4">CIA</td><td>Continuous Internal Examination – 1 (Mid-term)</td><td>10</td><td rowspan="4">30</td></tr>
<tr><td>Continuous Internal Examination – 2 (Mid-term)</td><td>10</td></tr>
<tr><td>AAT-1</td><td>5</td></tr>
<tr><td>AAT-2</td><td>5</td></tr>
<tr><td>SEE</td><td>Semester End Examination (SEE)</td><td>70</td><td>70</td></tr>
<tr><td colspan="3">Total Marks</td><td>100</td></tr>
</table>

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

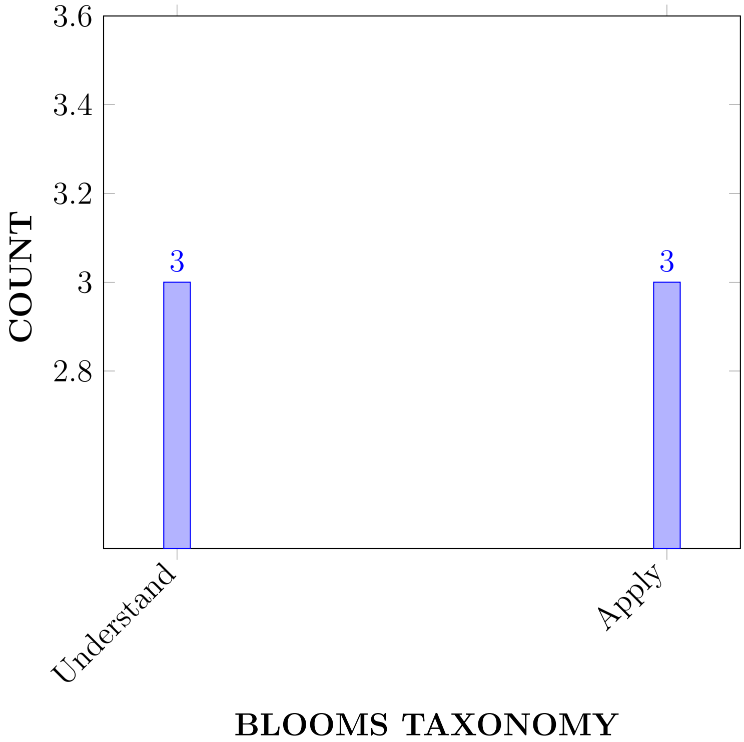
I	The concepts of electrochemical principles and causes of corrosion in the new development and breakthroughs efficiently in engineering and technology.
II	The different parameters to remove causes of hardness of water and their reactions towards the complexometric method.
III	The polymerization reactions with respect to mechanisms and its significance in industrial applications.
IV	The significance of green chemistry to reduce pollution in environment by using natural resources.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** the electrochemical principles, corrosion process in metals for protection of different metals from corrosion	Understand
CO 2	**Utilize** electrochemical cell parameters, electrochemical active surface area, current and over potential under given condition for calculating the electromotive force and electrode potential.	Apply
CO 3	**Identify** the hardness of water by different treatment methods for finding the hardness causing salts in water.	Apply
CO 4	**Compare** different types of polymerization reactions, mechanism of lubrication for utilizing in industries.	Understand
CO 5	**Make use** of green synthesis methods, different types of solid, liquid and gaseous fuels in terms of calorific value for utilizing in industries and automobiles.	Apply
CO 6	**Outline** the different types of natural resources and their applicability for understanding the effect of pollutants on air, water and soil that cause the environmental pollution.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Program Outcomes	
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/SEE/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1	CIE/SEE/AAT
PO 7	**Environment and sustainability:** understand the impact of the professional engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development. .	3	CIE/SEE/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking..	-	-
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	-	-
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies. .	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓		-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	✓	✓	-	-	-	-	✓	-	-	-	-	-	-	-	-
CO 6	✓	-	-	-	-	-	✓	-	-	-	-	-	-	-	-

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

Course Outcomes (COs)	POs / PSOs	Justification for mapping (Students will be able to)	No. of key competencies
CO 1	PO 1	**Explain** the operation of electrochemical systems in batteries, corrosion process in metals for protecting the metals from corrosion by using **principles of** science for solving **engineering problems**.	2
CO 2	PO 1	**Choose** different electrodes for finding pH of unknown solutions by applying **mathematical** expressions of cell potential by using **principles of science** and mathematics for solving **engineering** problems	3

	PO 2	**Identify** the problem **formulation and abstraction** for calculating electrode potential under non standard conditions by applying Nernst equation from the provided **information.**	2
CO 3	PO 1	**Explain** different treatment methods to produce soft water from raw water for solving **engineering problems** by applying the **principles of science.**	2
	PO 2	**Identify** the problem and formulate for finding the hardness of water in terms of CaCO3 equivalents with given **information and data** by applying **principles of science.**	2
CO 4	PO 1	**Illustrate** different types of polymerization reactions for synthesizing polymers from monomers, different types of lubricants to reduce friction in machines working under various temperature conditions by using **principles of science** for solving **engineering** problems	2
CO 5	PO 1	**Explain** the importance of green synthesis to minimize the generation of hazardous substances, different types of solid, liquid and gaseous fuels with their characteristics and calorific value by applying **mathematical** expressions for finding calorific value using **principles of science** and mathematics for solving engineering problems.	3
	PO 2	**Identify the given problem** and **formulate** for finding the calorific value of fuel with the given **information and data** by applying principles of science.	2
	PO 7	Make use of gaseous fuels like LPG, CNG to reduce the pollutants in atmosphere and know the impact in **socio economic and environmental** contexts for sustainable development.	2
CO 6	PO 1	**Explain** the concept of **living** and non living resources and the utility of these resources, effect of pollutants on air, water and soil that causes the environmental pollution for solving engineering problems by applying the **principles of science**	2
	PO 7	**Make use** of renewable and non renewable resources, control measures for air pollution, water pollution, soil pollution and noise pollution in **socio economic** an **environmental** contexts for sustainable development.	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	2	-	-	-	-	2	-	-	-	-	-	-	-	-
CO 6	2	-	-	-	-	-	2	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	8	2	2	2
CO 1	66.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	100	20	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	66.6	20	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	66.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	100	20	-	-	-	-	66.6	-	-	-	-	-	-	-	-
CO 6	66.6	-	-	-	-	-	66.6	-	-	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

2 - $40\% < C < 60\%$ –Moderate

1-5 $< C \leq 40\%$ – Low/ Slight

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	1	-	-	-	-	3	-	-	-	-	-	-	-	-
CO 6	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
TOTAL	18	3	-	-	-	-	6	-	-	-	-	-	-	-	-
AVERAGE	3	1	-	-	-	-	3	-	-	-	-	-	-	-	-

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	✓	5 Minutes Video	✓	Open Ended Experiments	✓
Assignments	✓				

XVII ASSESSMENT METHODOLOGY INDIRECT:

X	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**ELECTROCHEMISTRY AND BATTERIES**
	Electro chemical cells: Electrode potential, standard electrode potential, Calomel electrode and Nernstequation; Electrochemical series and its applications; Numerical problems; Batteries: Primary (Dry cell) and secondary batteries (Lead-acid storage battery, Li-ion battery). Corrosion: Causes and effects of corrosion: Theories of chemical and electrochemical corrosion, mechanism of electrochemical corrosion; Corrosion control methods: Cathodic protection, sacrificial anode and impressed current Cathodic protection; Surface coatings: Metallic coatings- Methods of coating- Hot dipping- galvanization and tinning, electroplating
MODULE II	**WATER TECHNOLOGY**
	Introduction: Hardness of water, causes of hardness; types of hardness: temporary and permanent hardness, expression and units of hardness; estimation of hardness of water by complexometric method; potable water and its specifications, Steps involved in the treatment of water, disinfection of water by chlorination and ozonization; External treatment of water; Ion-exchange process; Desalination of water: Reverse osmosis, numerical problems
MODULE III	**ENGINEERING MATERIALS**
	Polymers-classification with examples, polymerization-addition, condensation and co-polymerization; Plastics: Thermoplastics and thermosetting plastics; Compounding of plastics; Preparation, properties and applications of polyvinyl chloride, Teflon, Bakelite and Nylon-6, 6; Biodegradable polymers. Elastomers: Natural rubber, processing of natural rubber, vulcanization; Buna-s and Thiokol rubber; Lubricants: characteristics of lubricants, mechanism of lubrication – thick film, thin film, extreme pressure lubrication, properties – flash and fire point, cloud and pour point, viscosity and oiliness of lubricants.

MODULE IV	**GREEN CHEMISTRY AND FUELS**
	Introduction: Definition of green chemistry, methods of green synthesis: aqueous phase, microwave method, phase transfer catalyst and ultra sound method. Fuels: definition, classification of fuels ; Solid fuels: coal; analysis of coal: proximate and ultimate analysis; Liquid fuels: Petroleum and its refining; Gaseous fuels: Composition, characteristics and applications of LPG and CNG; Calorific value: Gross Calorific value(GCV) and Net Calorific value(NCV), numerical problems.
MODULE V	**NATURAL RESOURCES AND ENVIRONMENTAL POLLUTION**
	Natural resources: Classification of resources, living and nonliving resources; Water resources: Use and over utilization of surface and ground water, floods and droughts, dams, benefits and problems; Land resources; Energy resources: renewable and non-renewable energy sources, use of alternate energy source. Environmental pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution and noise pollution.

TEXTBOOKS

1. P. C. Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, 2017.
2. Shashi Chawla, "Engineering Chemistry", Dhanat Rai and Company, 2011, 1st Edition.
3. Prashanth rath, B.Rama Devi, Ch.Venkata Ramana Reddy, Subhendu Chakroborty, Cengage Learning Publishers, 1st Edition, 2018
4. Anubha Kaushik, C.P.Kaushik, "Environmental Studies" New Age International publishers, 4th Edition, 2015.
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1. 1. Dr.Bharathi Kumari, "A text book of Engineering Chemistry", VGS Book Links, 8th Edition,2016.
2. 2. B. Siva Shankar, "Engineering Chemistry", Tata McGraw Hill Publishing Limited, 3rd Edition, 2015.
3. 3. S. S. Dara, Mukkanti, "Text of Engineering Chemistry", S. Chand Co, New Delhi, 12thEdition, 2006.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	W1
CONTENT DELIVERY (THEORY)			
1	Outcome Based Education.		

2	Recall the concept of electro chemical cells.	CO 1	T1:6.1,R1: 2.6
3	Explain the electrode potential, standard electrode potential, electrochemical series and its applications.	CO 2	T1:6.2,R1: 2.9
4	Derive Nernst equation , numerical problems on cell potential.	CO 2	T1:6.5,R1: 2.6.3
5	Demonstate about calomel electrode. Batteries: primary (dry cell).	CO 1	T1: 6.7, R1:2.12
6	Explain the secondary batteries (Lead-acid storage battery), Li-ion battery.	CO 1	T1:6.12,R1: 2.12
7	Recognize the causes and effects of corrosion, chemical corrosion.	CO 1	T1:7.1, R1:2.14
8	Explain the electrochemical corrosion, mechanism of electrochemical corrosion.	CO 1	T1:7.2, R1:2.17
9	Explain about cathodic protection, sacrificial anode and impressed current.	CO 1	T1:7.14, R1:2.20
10	Apply metallic coatings, methods of coatings, hot dipping, galvanizing , tinning and electroplating.	CO 1	T1:7.14,R1: 2.22
11	Recall the hardness of water, causes of hardness.	CO 3	T1:1.3,R1: 1.4
12	Explain the types of hardness, temporary and permanent, units of hardness.	CO 3	T1:1.3,1.5,
13	Estimation of hardness of water by complexometric method,	CO 3	T1:1.5,R1: 1.6.2
14	Estimation of hardness of water by complexometric method.	CO 3	T1:1.14,R1: 1.6.4
15	Define potable water and its specifications, steps involved in treatment of water, disinfection of water by chlorination and ozonization.	CO 3	T1:1.12,R1: 1.6.5
16	Explain about external treatment of water; ion-exchange process.	CO 3	T1:1.11, R1:1.8.1
17	Explain about desalination of water: reverse osmosis.	CO 3	T1:1.13, R1:1.10
18	Recall polymers-classification with examples and Explain about the polymerization-addition, condensation and co- polymerization	CO 4	T1: 3.5,R1: 3.1
19	Explain the concept of compounding of plastics.	CO 4	T1:1.4, R1: 3.1.4
20	Expalin the preparation, properties and applications of polyvinyl chloride, teflon.	CO 4	T1:3.5,R1: 3.2
21	Explain the bakelite and nylon-6, 6.	CO 4	T1: 3.12,R1: 3.2.2
22	Define biodegradable polymers, synthetic biodegradable polymers.	CO 4	T1:3.14,R1: 3.2.3
23	Explain rubbers, natural rubber its process and vulcanization, Buna-s and thiokol rubber.	CO 4	T1: 3.15, R1:3.2.3
24	Elastomers: Synthetic rubbers,Buna-s and thiokol rubber.	CO 4	T1: 3.22, R1:3,3.4

25	Lubricants: characteristics of lubricants, mechanism of lubrication – thick film, thin film, extreme pressure lubrication.	CO 4	T1: 3.24,R1: 3.5
26	Properties–flash and fire point, cloud and pour point, viscosity and oiliness of lubricants.	CO 4	T1: 3.25,R1: 3.7
27	Definition and importance of green chemistry, methods of green synthesis: aqueous phase method.	CO 5	T5:6.8, T2:1.1
28	Explain the microwave method and phase transfer catalyst.	CO 5	T5: 6.8.3,T2: 8.1
29	Explain the ultra sound method.	CO 5	T5: 6.8.3, T2:9.2
30	Define fuels, classification of fuels and characteristics of a good fuels.	CO 5	T1:4.2, R1:6.2.1
31	Explain solid fuels, coal, Analysis of coal, proximate and ultimate analysis.	CO 5	T1:4.4.1, R1:7.1
32	Explain liquid fuels, petroleum and its refining.	CO 5	T1:4.5.2, R1:15.2
33	Explain the gaseous fuels, Composition, characteristics and applications of LPG and CNG.	CO 5	T1:4.6, R1:9.2
34	Apply the concept of calorific value, gross calorific value (GCV) and Net calorific value(NCV) to find calorific value of fuel, numerical problems.	CO 5	T1:4.8, R1:5.2
35	Recall natural resources: classification of resources, living and nonliving resources.	CO 6	T4:2.1
36	Explain the water resources: use and over utilization of surface and ground water, floods and droughts, Dams, benefits and problems.	CO 6	T4:2.2
37	Define energy resources, renewable and non-renewable energy sources.	CO 6	T4:2.3
38	Explain the alternate energy sources, land resources	CO 6	T4:2.5,5.2
39	Define environmental pollution, causes, effects and control of air pollution.	CO 6	T4: 4.2
40	Explain the causes, effects and control of water pollution.	CO 6	T4: 4.6
41	Explain the causes, effects and control of soil pollution and noise pollution.	CO 6	T4:4.12
PROBLEM SOLVING/ CASE STUDIES			
42	Problems on EMF of voltaic cell	CO 2	T1:6.2,R1: 2.9
43	Problems on EMF of a cell	CO 2	T1:6.5,R1: 2.6.3
44	Problems on electrode potential of the half cell by using Nernst equation	CO 2	T1:6.2,R1: 2.9
45	Problems on electrode potential of EMF of the cell by using Nernst equation.	CO 2	T1:6.5,R1: 2.6.3
46	Problems on temporary and permanent hardness in Degree French.	CO 3	T1:1.5, R1: 1.6.2
47	Problems on temporary, permanent and total hardness in ppm	CO 3	T1:1.14,R1: 1.6.4
48	Problems on the temporary, permanent and total hardness of water in Degree Clark.	CO 3	T1:1.5,R1: 1.6.2

49	Problems on the temporary, permanent and total hardness of water in Mg/L.	CO 3	T1:1.14,R1: 1.6.4
50	Problems on the total hardness in terms of calcium carbonate equivalents by using EDTA method.	CO 3	T1:1.5,R1: 1.6.2
51	Problems on the permanent hardness in terms of calcium carbonate equivalents by using EDTA method.	CO 3	T1:1.14,R1: 1.6.4
52	Problems on the temporary hardness in terms of calcium carbonate equivalents by using EDTA method.	CO 3	T1:1.5,R1: 1.6.2
53	Problems on the higher and lower calorific values of the fuel.	CO 5	T1:4.8, R1:5.2
54	Problems on the gross and net calorific values of the fuel.	CO 5	T1:4.8, R1:5.2
55	Problems on HCV and LCV	CO 5	T1:4.8, R1:5.2
56	Problems on GCV and NCV	CO 5	T1:4.8, R1:5.2
DISCUSSION OF DEFINITION AND TERMINOLOGY			
57	Definitions & terminology discussion on electrochemistry and corrosion	CO 1	T1:1.3,R1: 1.4
58	Definitions & terminology discussion on water technology	CO 3	T1: 3.5,R1: 3.1
59	Definitions & terminology discussion on engineering	CO 4	T1: 3.5,R1: 3.1
60	Definitions & terminology discussion on green chemistry and fuels	CO 5	T1:4.2, R1:6.2.1
61	Definitions & terminology discussion on natural resources and environmental pollution	CO 1, CO 6	T4:2.1,2.8
DISCUSSION OF QUESTION BANK			
62	Question bank discussion on electrochemistry and Corrosion	CO 1	T1: 6.1, R1:2.12
63	Question bank discussion on water technology	CO 3	T1:1.3, R1: 1.4
64	Question bank discussion on engineering materials	CO 4	T1: 3.5,R1: 3.1
65	Question bank discussion on green chemistry and fuels	CO5	T1:4.2, R1:6.2.1
66	Question bank discussion on natural resources and environmental Pollution	CO 6	T4:2.1,2.8

Course Coordinator: **HOD, CSE**
Dr V N S R Venkateswararao,Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	Computer Science And Engineering				
Course Title	Python Programming				
Course Code	ACSC01				
Program	B.Tech				
Semester	I	CSE			
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Mr. B Dilip chakravarthy, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC01	I	NIL

II COURSE OVERVIEW:

This course introduces students to writing computer programs. This course presents the principles of structured programming using the Python language, one of the most increasingly preferred languages for programming today. Because of its ease of use, it is ideal as a first programming language and runs on both the PC and Macintosh platforms. However, the knowledge gained in the course can be applied later to other languages such as C and Java. The course uses iPython Notebook to afford a more interactive experience. Topics include fundamentals of computer programming in Python,object-oriented programming and graphical user interfaces.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Python Programming	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
33.3 %	Remember
50 %	Understand
16.66 %	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

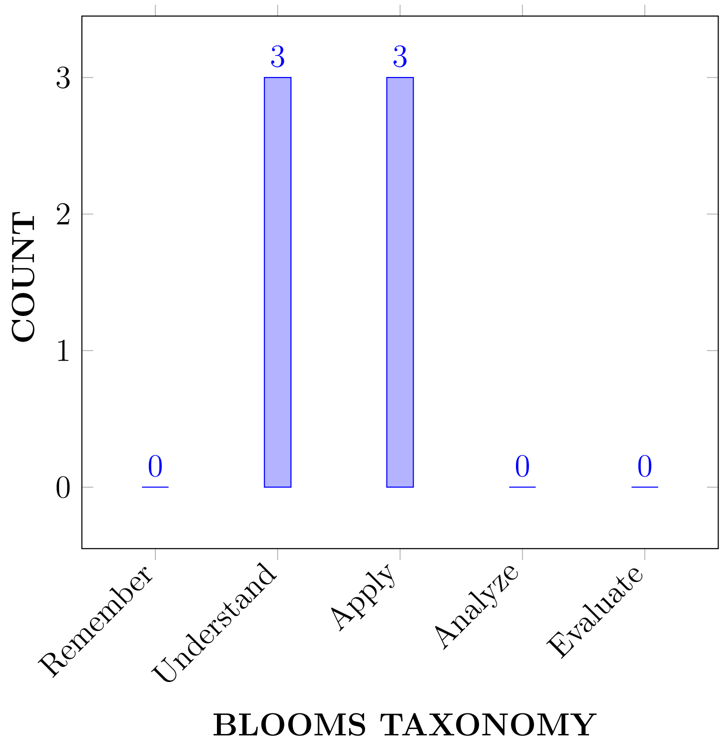
I	**Acquire programming skills in core Python**
II	**Acquire Object-oriented programming skills in Python.**
III	**Develop the skill of designing graphical-user interfaces (GUI) in Python.**
IV	**Develop the ability to write database applications in Python.**
V	**Acquire Python programming skills to move into specific branches - Internet of Things (IoT), Data Science, Machine Learning (ML), Artificial Intelligence (AI) etc.**

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** the basic concepts of python programming with the help of data types,operators, expressions, and console input/output.	Understand
CO 2	**Make use of** control statements for altering the sequential execution of programs in solving problems.	Apply
CO 3	**Demonstrate** operations on built-in container data types (list, tuple, set, dictionary) and strings.	Understand
CO 4	**Illustrate** operations and applications on strings with the help of built in functions.	Understand
CO 5	**Solve** the problems by using modular programming concepts through functions.	Apply
CO 6	**Identify** object oriented programming constructs for developing large, modular and reusable real-time programs.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature,and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	CIE/SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques,resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations.	3	CIE/SEE
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations,and give and receive clear instructions..	3	Tech Talk/Open Ended Experiments/Concept Vedios
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	3	CIE/SEE

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	3	Tech talk /Open ended experiments
PSO 3	Make use of appropriate tools for developing and evaluating cyber security systems.	3	Tech talk /Open ended experiments

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	✓	-	-	-	-	✓	-	-	✓		-
CO 2	✓	✓	✓	-	✓	-	-	-	-	✓	-	-	✓	-	✓
CO 3	✓	-	✓	-	✓	-	-	-	-	-	-	-	✓	-	✓
CO 4	✓	-	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 5	✓	✓	✓	-	✓	-	-	-	-	-	-	-	✓	-	-
CO 6	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Understand (knowledge) the basic concept of operators, precedence of operators and associativity while evaluating mathematical expressions in program statements. These concepts provide an insight into expression evaluation by applying the principles of mathematics and science.	3
CO 1	PO 5	With the help of modern engineering tools we can easily Understand the basic concept of operators, precedence of operators and associativity while evaluating mathematical expressions in program statements These concepts provide an insight into expression evaluation by applying the principles of mathematics and science.	1
CO 1	PO 10	Extend the knowledge of Python programming to communicate effectively with the Engineering community and society at large.	3
CO 1	PSO 1	Understand features of procedural as well as object-oriented programming while writing and analyzing computer programs in the areas related to Machine Learning, Big data and Artificial Intelligence	3
CO 2	PO 1	By applying the knowledge of mathematics,science and engineering fundameentals we can effectively use control statements.	3
CO 2	PO 2	Apply control statements in problem indentification,statement and validation .	5
CO 2	PO 3	Apply control statements to investigate and understand different complex engineering problems complex problems efficiently.	8
CO 2	PO 5	By applying control statements to model complex engineering activities	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 2	PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	3
CO 2	PSO 1	Apply features of procedural as well as object-oriented programming while writing and analyzing computer programs in the areas related to Machine Learning, Big data and Artificial Intelligence	3
CO 2	PSO 3	Acquire sufficient knowledge of object-oriented concepts and apply it in real-time for building successful career and doing higher studies.	3
CO 3	PO 1	Summarize indexing and slicing mechanisms for extracting a portion of data in a sequence using principles of mathematics, and engineering fundamentals.	3
CO 3	PO 3	Demonstrate the importance of indexing mechanisms in sequences such as lists, strings, sets, tuple and dictionary while developing solutions for complex engineering problems and design system using principles of mathematics, science, and engineering fundamentals. Use creativity to develop more innovative solutions.	6
CO 3	PO 5	Demonstarte lists,tuples and dictionaries With the usage of modern tools	1
CO 3	PSO 1	Summarize indexing mechanisms to design and develop efficient real-time computational problems.	3
CO 3	PSO 3	Infer sufficient knowledge of container data types and apply it in real-time for building successful career and doing higher studies.	3
CO 4	PO 1	Demonstrate different modules/packages in Python while developing solutions using the fundamentals of mathematics, science, and engineering.	3
CO 4	PO 3	Understand the usage of modules/packages while developing solutions for complex engineering problems and design system using principles of mathematics, science, and engineering fundamentals. Use creativity to develop more innovative solutions.	8
CO 4	PO 5	Interpret different string functions by using modern tools	1
CO 4	PO 10	Extend the focus to understand the usage of modules/packages and communicate effectively with the Engineering community and with society at large.	3
CO 4	PO 12	Summarize string handling functions to implement in project management	7
CO 4	PSO 1	Demonsrtate different modules to understand, design and analyze computer programs in reducing time and space complexities of various applications.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 4	PSO 3	Illustrate modern computer tools in implementing string handling mechanisms for various applications to become a successful professional in the domains.	3
CO 5	P0 1	Make use of parameter passing and different types of arguments in user-defined functions to design efficiently modular programs by applying the knowledge of mathematics, science, Engineering fundamentals.	3
CO 5	P0 2	Apply modular programming concepts for problem identification,formulation and data collection .	8
CO 5	PO 3	Select strong foundation of writing efficient modular programs using parameter passing mechanisms for career building by understanding the requirements and communicating effectively with engineering community.	7
CO 5	PO 5	Develop different functions by using modern tools	1
CO 5	PSO 1	Develop design and analyse python programming in the areas of concept of passing of parameters and arguments in functions to do modular programming.	3
CO 6	PO 1	Apply scientific principles and methodologies, Mathematical principles and other engineering disciplines for the procedural and object-oriented programming concepts used in Python.	3
CO 6	PO 2	Apply object oriented concepts in problem indentification,statement and validation .	7
CO 6	PO 3	Identify the need of object-oriented concepts while developing solutions for complex engineering problems and design system using principles of mathematics, science, and engineering fundamentals. Use creativity to develop more innovative solutions..	7
CO 6	PO 5	Develop object oriented principles using modern tools	1
CO 6	PO 10	Apply the knowledge of Python programming to communicate effectively with the Engineering community and society at large.	3
CO 6	PO 12	Identify the need of object oriented principles for preparation ad ability to engage in independent and lifelong learning	6
CO 6	PSO 1	Focus on writing programs using procedural and object oriented concepts for applications such as computational geometry, machine learning, Big data and AI by understanding and applying the engineering principles learning	3
CO 6	PSO 3	Acquire sufficient knowledge of object-oriented concepts and apply it in real-time for building successful career and doing higher studies.	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	1	-	-	-		3	-		3	-	-
CO 2	3	5	8	-	1	-	-	-	-	3	-	-	3	-	3
CO 3	3		6		1	-	-	-	-	-	-	-	3	-	3
CO 4	3	-	8	-	1	-	-	-	-	3	-	7	3		3
CO 5	3	8	7	-	1	-	-	-	-	-	-	-	3	-	-
CO 6	3	7	7	-	1	-	-	-	-	3	-	6	3	-	3

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	12	1	3	2
CO 1	100	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	60	0.0	0.0	100	0.0	0.0
CO 2	100	50	80	0.0	100	0.0	0.0	0.0	0.0	60	0.0	0.0	100	0.0	100
CO 3	100	0.0	60	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	100
CO 4	100	50	80	0.0	100	0.0	0.0	0.0	0.0	60	0.0	88	100	0.0	100
CO 5	100	80	70	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0
CO 6	100	80	70	0.0	100	0.0	0.0	0.0	0.0	60	0.0	75	100	0.0	100

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -5 $< C \leq 40\%$ – Low/ Slight

2 - 40 % $< C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	3	-	-	-	-	3	-	-	3	-	-
CO 2	3	2	3	-	3	-	-	-	-	3	-	-	3	-	3
CO 3	3	-	3	-	3	-	-	-	-	-	-	-	3	-	3
CO 4	3	-	3	-	3	-	-	-	-	3	-	3	3	-	3
CO 5	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-
CO 6	3	3	3	-	3	-	-	-	-	3	-	3	3	-	3
TOTAL	18	7	15	-	18	-	-	-	-	12	-	6	18	-	12
AVERAGE	3.0	2.3	3	-	3.0	-	-	-	-	3.0	-	3.0	3.0	-	3.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	case studies	-
Assignments	-	Open ended experiments	✓		

XVII ASSESSMENT METHODOLOGY-INDIRECT:

-	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**Introduction to Python**
	Introduction to Python: Features of Python, History and Future of Python, Working with Python – interactive and script mode, Identifiers and Keywords, Comments, Indentation and Multi-lining, Data types – built-in data types, Operators and Expressions, Console Input/Output, Formatted printing,Built-in Functions, Library Functions.
MODULE II	**DECISION CONTROL STATEMENTS**
	Selection/Conditional Branching Statements: if, if-else, nested if, if-elif-else statement(s), Basic Loop Structures/ Iterative Statements – while and for loop, Nested loops, break and continue statement, pass Statement, else Statement used with loops..
MODULE III	**CONTAINER DATA TYPES**
	Lists: Accessing List elements, List operations, List methods, List comprehension; Tuples: Accessing Tuple elements, Tuple operations, Tuple methods, Tuple comprehension, Conversion of List comprehension to Tuple, Iterators and Iterables, zip() function. Sets: Accessing Set elements, Set operations, Set functions, Set comprehension;Dictionaries: Accessing Dictionary elements, Dictionary operations, Dictionary Functions, Nested Dictionary, Dictionary comprehension.s.
MODULE IV	**STRINGS AND FUNCTIONS**
	Strings: Accessing string elements, string properties, string operations. Functions: Communicating with functions, Variable Scope and lifetime, return statement, Types of arguments, Lambda functions, Recursive functions..
MODULE V	**CLASSES AND OBJECTS**
	Classes and Objects – Defining Classes, Creating Objects, Data Abstraction and Hiding through Classes, Class Method and self Argument, Class variables and Object variables, init() and de () method, Public and private data members, Built-in Class Attributes, Garbage Collection. OOPs Features:Abstraction, Encapsulation, Inheritance, and Polymorphism.

TEXTBOOKS:

1. Reema Thareja, "Python Programming - Using Problem Solving Approach", Oxford Press, 1st Edition, 2017.
2. Dusty Philips, "Python 3 Object Oriented Programming", PACKT Publishing, 2nd Edition,2015.

REFERENCE BOOKS:

1. Yashavant Kanetkar, Aditya Kanetkar, "Let Us Python", BPB Publications, 2nd Edition, 2019.
2. Martin C. Brown, "Python: The Complete Reference", Mc. Graw Hill, Indian Edition, 2018.
3. Michael H. Goldwasser, David Letscher, "Object Oriented Programming in Python", Prentice Hall, 1st Edition, 2007.
4. Taneja Sheetal, Kumar Naveen, "Python Programming – A Modular Approach", Pearson, 1st Edition, 2017
5. Nageswar Rao, "Core Python Programming", Dreamtech Press, 2018.

COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
	Discussion on mapping COs with POs. (OBE)		
CONTENT DELIVERY (THEORY)			
1-2	Introduction to Python: Features of Python, History and Future of Python	CO 1	T1:3.1 –3.3
3-4	Working with Python – interactive and script mode, Identifiers and Keywords, Comments, Indentation and Multi-lining, Databtypes – built-in data types	CO 1	T1:3.4-3.9
5-8	Operators and Expressions	CO 1	T1:3.12
9-10	Console Input/Output, Formatted printing, Built-in Functions, Library Functions	CO 1	T1:3.15
11-14	Control Statement(s)	CO 2	T1: 4.1 –4.8
15-17	Lists and Tuples	CO 3	T1:3.15
18-19	Conversion of List comprehension to Tuple, Iterators and Iterables, zip() function	CO 3	T1:3.15
20-21	Sets, Dictionaries:	CO 3	T1:3.15
22-23	Nested Dictionary, Dictionary comprehension	CO 3	T1:3.15
24-25	Strings: Accessing string elements, string properties, string operations	CO 4	T1: 6.1 –6.8
26-27	Functions: Communicating with functions, Variable Scope and lifetime, return statement	CO 5	T1:5.1 –5.5

28-29	Types of arguments, Lambda functions, Recursive functions	CO 5	T1:5.6 –5.8
30-31	Classes and Objects – Defining Classes, Creating Objects	CO 6	T1 : 9.1 – 9.3
32-33	Data Abstraction and Hiding through Classes, Class Method and self Argument	CO 6	T1: 9.2 – 9.4
34-36	Class variables and Object variables, init() and del () method	CO 6	T1:9.5 – 9.7
37-38	Public and private data members, Built-in Class Attributes, Garbage Collection	CO 6	T1:9.8 – 9.13
39-41	OOPs Features: Abstraction, Encapsulation, Inheritance, and Polymorphism	CO 6	T1:10.1-10.3
PROBLEM SOLVING/ CASE STUDIES			
1	Data Types	CO 1	T1:3.7.1-3.7.4
2	Operators and Expressions	CO 1	T1:3.12.1-3.12.10
3	Built-in Functions , Library functions	CO 1	T1:6.4-6.10
4	Conditional branching Statements	CO 2	T1:4.1-4.2
5	Iterative Statements	CO 2	T1:4.3-4.8
6	Lists	CO 3	T1:8.2-8.2.10
7	Tuples	CO 3	T1:8.4.1
8	Sets	CO 3	T1:8.5.1
9	Dictionaries	CO 3	T1:8.6.1-8.6.12
10	Strings	CO 4	T1:6.1-6.10
11	Functions	CO 5	T1:5.1:5.10
12	Classes and Objects	CO 6	T1:9.1-9.15
13	__init()__and __del__() method	CO 6	T1:9.4-9.6
14	Inheritance	CO 6	T1:10.1-10.4
15	Polymorphism	CO 6	T1:10.2.1
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Define bound and unbound variable.	CO 1	T1:9.1
2	Define a control structure?	CO 2	T1:4.1-4.8
3	How to slice lists in Python?	CO 3	T1:8.2-8.6
4	Write the syntax of defining a function?	CO 5	T1:5.1-5.2

5	List out the features of object oriented programming.	CO 6	T19.1-9.3
DISCUSSION OF QUESTION BANK			
1	Write the features and applications of Python programming language?	CO 1	T1:3.1-3.3
2	Write a program to calculate the roots of a quadratic equation?	CO 1	T1:3.5-3.7
3	Write a program to remove all duplicate elements from a list?	CO 3	T1:8.2-8.6
4	Write a program that accepts a string from user and redisplays the same string after removing vowels from it?	CO 4	T1:6.1-6.3
5	Write a program that has a class Person string name and date of birth (DOB) of a person. The program should subtract the DOB from today's date to find out whether a person is eligible for vote or not?	CO 6	T1:9.1-9.3

Course Coordinator
B Dilip Chakravarty

HOD CSE(CS)

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**Computer Science and Engineering**				
Course Title	**BASIC ELECTRICAL ENGINEERING**				
Course Code	AEEC01				
Program	B.Tech				
Semester	I	CSE/CSE(AI&ML)/CSE(CS)/CS&IT/CSE(DS)/IT			
Course Type	Foundation				
Regulation	IARE - UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms.T Saritha Kumari, Assistant Professor,EEE				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSC02	I	Linear Algebra and Calculus

II COURSE OVERVIEW:

The Basic Electrical Engineering enables knowledge on electrical quantities such as current, voltage, and power, energy to know the impact of technology in global and societal context. This course provides knowledge on basic DC and AC circuits used in electrical and electronic devices, highlights the importance of transformers, electrical machines in generation, transmission and distribution of electric power, identify the types of electrical machines suitable for particular applications.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Fluid Dynamics	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
17%	Remember
50%	Understand
33%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

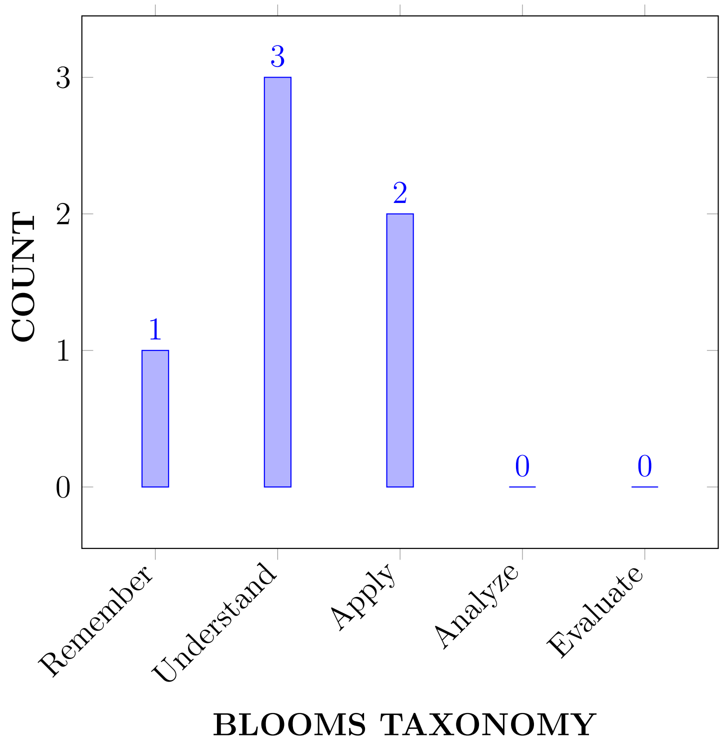
I	The fundamentals of electrical circuits and analysis of circuits with DC excitation using circuit laws.
II	The application of circuit laws in network theorems and graph theory to simplify complex networks.
III	The construction and working principle of DC generator, DC motor, andtypes of DC machines based on field excitation method.
IV	The theory of Faraday's law of mutual induction and working of single phase transformer.
V	The concept of rotating magnetic field and constructional features, principle and types of AC machines.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Solve** complex electrical circuits by applying network reduction techniques for reducing into a simplified circuit.	Apply
CO 2	**Define** basic nomenclature of single phase AC circuits for obtaining impedance, admittance of series and parallel circuits.	Remember
CO 3	**Make use of** various network theorems and graph theory for simplifying complex electrical networks.	Apply
CO 4	**Demonstrate** the construction, principle and working of DC machines for their performance analysis.	Understand
CO 5	**Illustrate** working , construction and obtain the equivalent circuit of single phase transformers.	Understand
CO 6	**Explore** electromagnetic lawsused for the construction and opertaion of synchronous and asynchronous machines.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
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Program Outcomes	
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	1	Quiz

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 2	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 4	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 5	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 6	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	**PO 1**	Recollect the concept of electricity is described through scientific principles, importance Kirchhoff laws in relation with law of conservation of energy and charge circuits are explained using mathematics, engineering fundamentals and various source transformation techniques are adopted for solving complex circuits.	3
	PO 2	Derive standard expressions for equivalent resistances, inductances and capacitance by using series-parallel networks i.e mathematical calculations.	1
	PSO 1	Solve complex electrical circuits by applying basic circuit concepts by using computer programs.	1
CO 2	**PO 1**	Make use of Alternating quantity for obtaining form, peak factor concept of impedance and admittance using the knowledge of mathematics, science, and engineering fundamentals.	3
CO 3	**PO 1**	Demonstrate various network theorems in order to determine the same using principles of mathematics, science, and engineering fundamentals.	3
	PO 2	Verify various network theorems for their validation using mathematical calculations.	1
	PSO 1	Simplify complex electrical networks by applying various circuit theorems by using computer programs.	1
CO 4	**PO 1**	The principle of operation and characteristics of DC machines are explained by applying engineering fundamentals including device physics.	3
CO 5	**PO 1**	Understand how classification DC machines are done and their power flow with the knowledge of mathematics and engineering sciences.	3
	PSO 1	Develop equivalent circuit of single phase transformer referred to both sides by developing computer programs.	1
CO 6	**PO 1**	Understand the working of induction motors and alternators using engineering principles and mathematical equations.	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 6	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	10	-	-	-	-	-	-	-	-	-	-	25	-	-
CO 2	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	100	10	-	-	-	-	-	-	-	-	-	-	25	-	-
CO 4	100	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 5	100	-	-	-	-	-	-	-	-	-	-	-	25	-	-
CO 6	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\ \% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 4	3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 5	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 6	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	18	2	-	-	-	-	-	-	-	-	-	-	3	-	-
AVERAGE	3.0	0.3	-	-	-	-	-	-	-	-	-	-	0.5	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	-				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO ELECTRICAL CIRCUITS**
	Circuit concept: Ohm's law, Kirchhoff's laws, equivalent resistance of networks, Source transformation, Star to delta transformation, mesh and nodal analysis; Single phase AC circuits: Representation of alternating quantities, RMS, average, form and peak factor, concept of impedance and admittance.
MODULE II	**NETWORK THEOREMS AND NETWORK TOPOLOGY**
	Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum power transfer for DC excitations circuits. Network Topology: Definitions, Graph, Tree, Incidence matrix, Basic Cut Set and Basic Tie Set Matrices for planar networks.
MODULE III	**DC MACHINES**
	DC generators: Principle of operation, construction, EMF equation, types of DC generators. Losses and efficiency. DC motors: Principle of operation, back EMF, torque equation, types of DC motors, Losses and efficiency, numerical problems.
MODULE IV	**SINGLE PHASE TRASNFORMERS**
	Single Phase Transformers: Principle of operation, construction, types of transformers, EMF equation, operation of transformer under no load and on load, Phasor diagrams, equivalent circuit, efficiency, regulation and numerical problems.
MODULE V	**AC MACHINES**
	Three Phase Induction motor: Principle of operation, slip, slip -torque characteristics, efficiency and applications; Alternators: Introduction, principle of operation, constructional features, calculation of regulation by synchronous impedance method and numerical problems.

TEXTBOOKS

1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6thEdition,2004.
2. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1stEdition,2013.
3. WillianmHayt, Jack E Kemmerly S M Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7thEdition,2010.
4. J P J Millman, C CHalkias, SatyabrataJit, "Millmans Electronic Devices and Circuits", Tata McGraw Hill, 2ndEdition,1998.

5. R L Boylestad, Louis Nashelsky, “Electronic Devices and Circuits”, PEI / PHI, 9th Edition, 2006.
6. V K Mehta, Rohit Mehta, —Principles of electrical engineering, S CHAND, 1st Edition, 2003.

REFERENCE BOOKS:

1. David A Bell, “Electric Circuits”, Oxford University Press, 9thEdition,2016.
2. U A Bakshi,Atul P Godse “Basic Electrical and Electronics Engineering”TechnicalPublications, 9thEdition,2016.
3. A Bruce Carlson, “Circuits”, Cengage Learning, 1stEdition,2008.
4. M Arshad, “Network Analysis and Circuits”, Infinity Science Press, 9thEdition,2016.

WEB REFERENCES:

1. http://www.igniteengineers.com
2. http://www.ocw.nthu.edu.tw
3. http://www.uotechnology.edu.iq

COURSE WEB PAGE:

1. https://www.iare.ac.in/?q=courses/computer-science-engineering-autonomous/basic -electrical-engineering

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO’s	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
2	Electrical Circuits: Basic definitions, Types of elements	CO 1	T1-5.2 to 5.3
3	Ohm’s Law, Kirchhoff Laws	CO 1	T1-5.4 to 5.5
4	Series, parallel circuits	CO 2	T1-5.5 to 5.8
5	Derivation for Star-delta and delta-star transformations	CO 2	T1-5.8 to 5.9
6	Mesh analysis and Nodal Analysis	CO 2	T1-5.11 to 5.12
7	Representation of alternating quantities	CO 3	T1-5.14 to 5.15
8	RMS and Average values of an AC signal	CO 2	T1-5.16 to 5.16

9	Form and peak factor, concept of impedance and admittance	CO 2	T1-5.16 to 5.16
10	Superposition theorem for DC excitations circuits	CO 3	T1-6.1 to 6.3
11	Reciprocity theorem for DC excitation	CO 3	T1-6.8 to 6.9
12	Thevenin's theorem for DC excitations circuits	CO 3	T1-6.2 to 6.3
13	Norton's theorem for DC excitations circuits	CO 3	T1-6.3 to 6.4
14	Maximum power transfer theorem for DC excitations circuits	CO 3	T1-11.1
15	Incidence matrix for planar networks	CO 3	T1-11.2 to 11.3
16	Basic Cut Set matrix for planar networks	CO 4	T1-11.2 to 11.3
17	Basic Tie Set matrix for planar networks	CO 3	T1-11.9 to 11.10
18	Principle of operation for DC generators	CO 4	R2-7.1 to 7.2
19	Construction and EMF equation for DC generators	CO 4	R2-7.4
20	Types of DC generators	CO 4	R2-7.3
21	Principle of operation for DC motors	CO 4	R2-7.3.1 to 7.3.2
22	Back EMF, torque equation for DC motors	CO 4	R2-7.3.3 to 7.3.6
23	Types of DC motors	CO 4	R2-7.6
24	Losses and efficiency for DC generators, motors	CO 4	T1-13.1 to 13.3
25	Principle of operation for Single Phase Transformers	CO 5	T1-13.1 to 13.3
26	Construction and EMF equation for Single Phase Transformers	CO 5	T1-13.5 to 13.6
27	Types of transformers and turns ratio	CO 5	T1-13.6 to 13.7
28	Operation of transformer under no load	CO 5	T1-13.7 to 13.9
29	Operation of transformer under on load	CO 5	T1-13.8
30	Equivalent circuit for Transformers	CO 5	T1-17.1 to 17.2
31	Phasor diagrams of transformer	CO 5	T1-17.3 to 17.4
32	Losses of Transformers	CO 5	T1-17.6 to 17.7
33	Efficiency of Transformers	CO 5	T1-13.11
34	Regulation for Transformers	CO 5	T1-13.12
35	Three Phase Induction motor: Principle of operation	CO 5	T1-13.13
36	slip, slip -torque characteristics	CO 6	T1-13.14

37	Efficiency of Induction motor	CO 6	T1-13.16 to 13.18
38	Applications of Induction motor	CO 6	T1-13.19
39	Alternators: Introduction, principle of operation	CO 6	T1-13.19
40	Constructional features	CO 6	T1-13.20
41	Calculation of regulation by synchronous impedance method and numerical problems.	CO 6	T1-13.20
PROBLEM SOLVING/ CASE STUDIES			
42	Numerical Examples on electrical quantities, Ohm's law, KCL, KVL	CO 2	T1-5.8 to 5.9
43	Numerical Examples on series, parallel elements and star to delta transformation and mesh analysis	CO 2	T1-5.5 to 5.8
44	Numerical Examples on nodal analysis and alternating quantities	CO 3	T1-6.8 to 6.9
45	Numerical Examples on Superposition theorem	CO 3	T1-6.2 to 6.3
46	Numerical Examples on reciprocity and maximum power transfer theorems	CO 3	R2-7.1 to 7.2
47	Numerical Examples on Thevenin's and Norton's theorems	CO 3	T1-13.1 to 13.3
48	Numerical Examples on Basic cut set and Tie set matrices	CO 3	T1-13.5 to 13.6
49	Numerical Examples on EMF equation and types of DC generators	CO 4	T1-13.6 to 13.7
50	Numerical Examples on torque equation of DC motor	CO 4	T1-13.1 to 13.3
51	Numerical Examples on types of DC motors	CO 4	T1-13.13
52	Numerical Examples on EMF equation and equivalent circuit of 1 phase transformer	CO 5	T1-13.16 to 13.18
53	Numerical Examples on, efficiency for Transformers	CO 5	T1-13.14
54	Numerical Examples on, regulation for Transformers	CO 5	T1-13.16 to 13.18
55	Numerical Examples on EMF of Alternators	CO 6	T1-13.19
56	Numerical Examples on regulation of Alternators	CO 6	T1-13.20
DISCUSSION OF DEFINITION AND TERMINOLOGY			
57	Definitions and terminology from basics of electrical circuits	CO 1	T1-5.1 to 5.3
58	Definitions on network theorems	CO 3	T1-6.1 to 6.3
59	Definitions on DC machines	CO 4	R2-7.1 to 7.2
60	Definitions on single phase transformers	CO 5	T1-13.1 to 13.3
61	Definitions on AC machines	CO 6	T1-13.11
DISCUSSION OF QUESTION BANK			
62	Questions from electrical circuits	CO 1	T1-5.1 to 5.3

63	Questions from network theorems	CO 3	T1-6.1 to 6.3
64	Questions from DC machines	CO 4	R2-7.1 to 7.2
65	Questions from single phase transformers	CO 5	T1-13.1 to 13.3
66	Questions from AC machines	CO 6	T1-13.11

Mrs T Saritha Kumari, Asst Professor **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Course Title	PYTHON PROGRAMMING LABORATORY				
Course Code	ACAC02				
Program	B.Tech				
Semester	I	CSE			
Course Type	Core				
Regulation	IARE - UG 20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	1	-	-	2	2
Course Coordinator	Ms Jalaja Vishnubhotla, Assistant Professor CSE (AI&ML)				

I COURSE OVERVIEW:
This course introduces students to writing computer programs. This course presents the principles of structured programming using the Python language, one of the most increasingly preferred languages for programming today. Because of its ease of use, it is ideal as a first programming language and runs on both the PC and Macintosh platforms. However, the knowledge gained in the course can be applied later to other languages such as C and Java.The course uses iPython Notebook to afford a more interactive experience. Topics include fundamentals of computer programming in Python, object-oriented programming and graphical user interfaces.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSC02	I	-

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
PYTHON PROGRAMMING LABORATORY	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

X	Demo Video	X	Lab Worksheets	X	Viva Questions	X	Probing further Questions

V EVALUATION METHODOLOGY:
Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	Acquire programming skills in core Python.
II	Acquire Object-oriented programming skills in Python.
III	Develop the skill of designing graphical-user interfaces (GUI) in Python.
IV	Develop the ability to write database applications in Python
V	Acquire Python programming skills to move into specific branches - Internet of Things (IoT), Data Science, Machine Learning (ML), Artificial Intelligence (AI) etc.

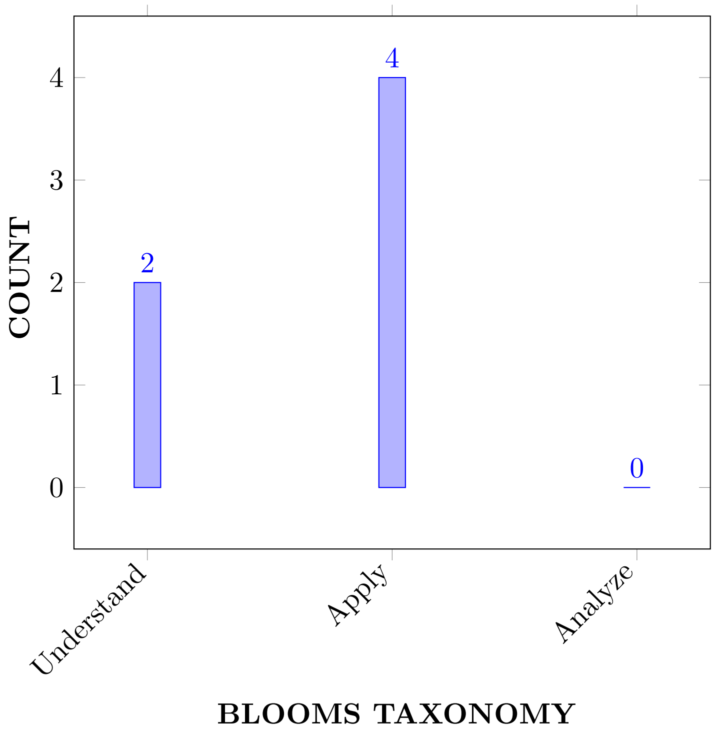
VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** the basic concepts of python programming with the help of data types, operators and expressions, console input/output	Understand
CO 2	**Make use of** control statements for altering the sequential execution of programs in solving problems.	Apply
CO 3	**Demonstrate** operations on built-in container data types (list, tuple, set, dictionary) and strings.	Understand

CO 4	**Make use of** operations and applications on strings with the help of built in functions	Apply
CO 5	**Solve** the problems by using modular programming concepts through functions.	Apply
CO 6	**Identify** object-oriented programming constructs for developing large, modular and reusable real-time programs	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / SEE/ Lab Exercises
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	CIE / SEE/ Lab Exercises
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	CIE / SEE/ Lab Exercises

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	3	Lab Exercises
PSO 2	Focus on improving software reliability, network security or information retrieval systems		
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	**Justification for mapping (Students will be able to)**	No. of Key Competencies
CO 1	PO 1	Demonstrate the data types of Python Programming by understating their importance and applicability (apply) in. **solving (complex) engineering problems by applying the principles of Mathematics and Engineering.**	3
	PO 2	Demonstrate the data types of Python Programming **with provided information and data in reaching substantiated conclusions by the interpretation of results.** .	3

	PO 5	Demonstrate the data types,operators,expressions and console I/O of Python Programming **for solving problems with the help of built in functions in Python programming**.	3
	PSO 3	Use datatypes,operators and expressions of Python Programming **in solving mathematical and statistical problems**	3
CO 2	PO 1	Illustrate the usage of control statements in solving real world problems **by applying principles of Mathematics, Science and Engineering.**	3
	PO 2	Illustrate the usage of control statements in solving real world problems **for visualizing the distribution of data in solving analysis problems.** .	2
	PO 5	Illustrate the usage of control statements along with built in functions of Python programming **for visualizing distribution of data with the help of built in function in Python programming language** .	3
	PSO 3	Use real time data to implement machine learning basics with Python programming **by analyzing the data and its relationships.** .	3
CO 3	PO 1	Illustrate the operations on built in container data types and strings **by applying the principles of Mathematics, Science and Engineering.** .	3
	PO 2	Illustrate the operations on built in container data types and strings in solving (complex) data centric engineering problems **from the provided information and substantiate with the interpretation of variations in the results.** .	3
	PSO 3	Implement the Python Programming basics **by exploring data analysis to solve complex problems.** .	3
CO 4	PO 1	Conclude the insights of data using exploratory data analysis **by applying the principles of Mathematics, Science and Engineering.**.	3
	PO 5	Define the list of operations on strings using built in functions **Find the different ways to model data and understand the limitations.**.	2
	PSO 3	Implement all string related operations using Python Programming programming **by exploring data limitations for generating predictions.** .	3
CO 5	PO 1	Apply the Modular Approach real world problems **by understanding the concepts of functions and code reusability**.	3
	PO 3	Understand the given problem statement and formulate (complex) engineering system **for developing a modular approach in solving problems that meet specified needs**.	2
	PO 5	Make use of functions **for creating the concept of code reusability**.	3

	PSO 3	Understand the concept of modularity by implementing different user defined and built functions **from real world problems to visualize the data to analyze the complexity.**.	3
CO 6	PO 1	Apply the knowledge of **engineering fundamentals**, and an **Mathematics and Engineering fundamentals principles to create a object oriented model on real time problems**.	3
	PO 3	Apply object oriented and modular concepts on **solving real world problems** reaching **and reusable conclusions**.	3
	PSO 3	Use built in functions in Python **for solving modular and reusable real time problems**.	3

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES				PROGRAM OUTCOMES		
	PO 1	PO 2	PO 3	PO 5	PSO 1	PSO 2	PSO 3
CO 1	2		2	3			3
CO 2	3		3				3
CO 3	3	2	3				3
CO 4	3		3				3
CO 5	3	2	3				3
CO 6	3	2	3				3

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK 1	**OPERATORS**
	a.Read a list of numbers and write a program to check whether a particular element is present or not using membership operators. b. Read your name and age and write a program to display the year in which you will turn 100 years old c. Read radius and height of a cone and write a program to find the volume of a cone d.Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)
WEEK 2	**CONTROL STRUCTURES**
	a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if...elif...else statement. b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop c. Write a Program to find the sum of a Series 1/1! + 2/2! + 3/3! + 4/4! +.......+ n/n!. (Input :n = 5, Output : 2.70833)
WEEK 3	**LIST**
	a. Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5). b. Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24) c. Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84) d. Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])
WEEK 4	**TUPLE**
	a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. testlist = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)] b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: testlist = [("GFG", "IS", "BEST"), ("GFg", "AVERAGE"), ("GfG",), ("Gfg", "CS")], Output : [(GFG, IS, BEST)]). c. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)
WEEK 5	**SET**

	a.Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x). b.Write a program to perform union, intersection and difference using Set A and Set B. c.Write a program to count number of vowels using sets in given string (Input : “Hello World”, Output: No. of vowels : 3) d.Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input : S1 = ”aacdb”, S2 = ”gafd”, Output : ”cbgf”).
WEEK 6	**DICTIONARY**
	a. Write a program to do the following operations: i. Create a empty dictionary with dict() method ii. Add elements one at a time iii. Update existing keys value iv. Access an element using a key and also get() method v. Deleting a key value using del() method b. Write a program to create a dictionary and apply the following methods: i. pop() method ii. popitem() method iii. clear() method c.Given a dictionary, write a program to find the sum of all items in the dictionary
WEEK 7	**STRINGS**
	a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward. b. Write a program to read a string and count the number of vowel letters and print all letters except ’e’ and ’s’. c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country) d. Write a program to read a string and count how many times each letter appears. (Histogram)
WEEK 8	**USER DEFINED FUNCTIONS**
	a. A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n. b.Write a function mergedict(dict1, dict2) to merge two Python dictionaries. c.Write a fact() function to compute the factorial of a given positive number. d.Given a list of n elements, write a linearsearch() function to search a given element x in a list.
WEEK 9	**BUILT-IN FUNCTIONS**

	a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library b. Write a program to demonstrate the working of built-in trignometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module c. Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
WEEK 10	**CLASS AND OBJECTS**
	a.Write a program to create a BankAccount class. Your class should support the following methods for i) Deposit ii) Withdraw iii) GetBalanace iv) PinChange b.Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance). c.Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employeeinfo() method and also using dictionary dict. d.Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.
WEEK 11	**MISCELLANEOUS PROGRAMS**
	Write a program to find the maximum and minimum K elements in Tuple using slicing and sorted() method (Input: testtup = (3, 7, 1, 18, 9), k = 2, Output: (3, 1, 9, 18)) b. Write a program to find the size of a tuple using getsizeof() method from sys module and built-in sizeof() method c.Write a program to check if a substring is present in a given string or not d. Write a program to find the length of a string using various methods: i. Using len() method ii. Using for loop and in operator iii. Using while loop and slicing
WEEK 12	**ADDITIONAL PROGRAMS - FILE HANDLING**
	a. Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform the following operations: i. Count the sentences in the file. ii. Count the words in the file. iii. Count the characters in the file. b. Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file should store only lower case alphabets and display the number of lines copied c.Write a Python program to store N students records containing name, roll number and branch. Print the given branch students details only.

TEXTBOOKS

1. Michael H Goldwasser, David Letscher, “Object Oriented Programming in Python”, Prentice Hall, 1st Edition, 2007.
2. Yashavant Kanetkar, Aditya Kanetkar, “Let us Python”, BPB publication, 1st Edition, 2019

3. Ashok Kamthane, Amit Kamthane, "Programming and Problem Solving with Python", McGraw Hill Education (India) Private Limited, 2018.
4. Taneja Sheetal, Kumar Naveen, "Python Programming – A modular approach", Pearson, 2017

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1. www.oikostat.ch.
2. https://realpython.com/python3-object-oriented-programming//
3. https://python.swaroopch.com/oop.html#syllabus.
4. https://python-textbok.readthedocs.io/en/1.0/ObjectOrientedProgramming.html/

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Operators	CO 1	R1: 1
2	Control structures	CO 1	R3: 2
3	List	CO 2	R1: 7
4	Tuple	CO 2	R1: 8
5	Set	CO 3	R1: 2.4
6	Dictionary	CO 3	R1: 9
7	Strings	CO 4	R1: 10
8	User Defined Functions	CO 4	R3: 15
9	Built in Functions	CO 5	R1: 9
10	Class and Objects	CO5	R1: 10
11	Miscelaneous Programs	CO 6	R4:7
12	Additionaal programs - File Handling	CO 6	R4:10

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Python program to Right rotate a numpy array to n.
2	Python program to multiply all elements in a Dictionary.
3	Python Program to put positive and negative numbers in a seperate list.
4	Python program to remove given key from a Dictionary.

Signature of Course Coordinator **HOD, CSE(AI&ML)**
Ms Jalaja Vishnubhotla, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Course Title	**ENGINEERING WORKSHOP PRACTICE**				
Course Code	AMEC04				
Program	B.Tech				
Semester	I	CSE			
Course Type	FOUNDATION				
Regulation	IARE - UG 20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	2	1
Course Coordinator	Mr. Gooty Rohan, Assistant Professor				

I COURSE OVERVIEW:

Engineering workshop Practice is intended to enhance the learning experience of the student about engineering tools for cutting and measuring used in a workshop. Students are expected to gain experience in hands on training as well as knowledge to carry out a particular process for making a product using the basic manufacturing devices used in Workshop.

II COURSE PRE-R‘EQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	-	-

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Engineering Workshop Practice	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing Further Experiments

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day-to-day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component	**Laboratory**		Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

A. Experiment Based

Objective	**Analysis**	**Design**	**Conclusion**	**Viva**	**Total**
2	2	2	2	2	10

B. Programming Based

Purpose	**Algorithm**	**Program**	**Conclusion**	**Viva**	**Total**
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

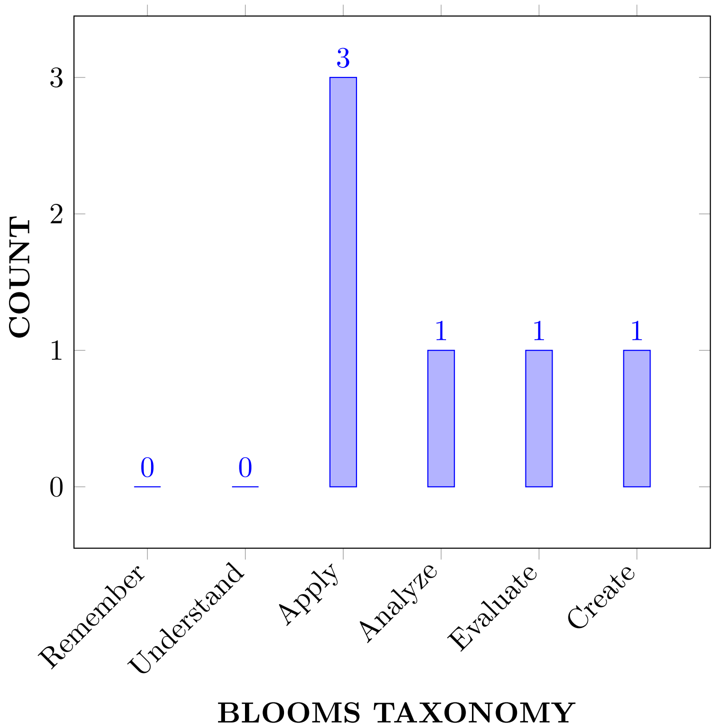
I	The application of jigs and fixtures, measuring, marking and cutting tools in various types of manufacturing processes.
II	The preparation of different joints in carpentry and fitting and also familiarizes wood working machinery.
III	The concepts of forming processes by forging, black-smithy and tin-smithy with an application extracts of Engineering Drawing.
IV	The standard electrical wiring practices for domestic and industrial appliances.
V	The current advancements in developing the prototype models through digital manufacturing facilities.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** the conventional representation of materials and machine elements for making a desired product with given work piece.	Apply
CO 2	**Determine** the ability to Produce Fitting jobs as per specified dimensions in addition to demonstrating proficiency with hand tools common in fitting.	Evaluate
CO 3	**Create** a desired shape with given metal rod by using fire and furnaceto convert given shape into useable elements using basic blacksmith techniques.	Create
CO 4	**Organize** the moulding techniques along with suitable tools for producing casting of different and complex shapes using various patterns.	Apply
CO 5	**Develop** the various engineering and household products by using tin simthy instruments/machinesfor manufacturing the tin boxes, cans, funnels, ducts etc., from a flat sheet of metal.	Apply
CO 6	**Compare** various electrical circuits by using conduit system of wiring to prepare different types of electrical connection on the given circuit boards using appropriate electrical tools.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Lab Exercises
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	CIA
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	2	Lab Exercises
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	3	SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	**Justification for mapping (Students will be able to)**	No. of Key Competencies
CO 1	PO 1	Apply the knowledge of engineering fundamentals to join given wooden pieces according to given sketch to develop required joint.	1
	PO 3	Conversion of given design into a practical output using design solution for complex engineering problems and design system components	2

	PO 5	Develop the given resources and engineering tools into proper fitment as given in the diagrammatical representation.	2
	PO 11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	2
	PSO 3	Make use of Experimental tools for Building Career Paths towards Innovation Startups, Employability in different mechanical trades.	2
CO 2	PO 1	Apply the knowledge of engineering fundamentals to join given metal pieces according to given sketch to develop required joint.	1
	PO 5	Develop the given resources and engineering tools into proper fitment as given in the diagrammatical representation.	2
	PO 11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	2
	PSO 3	Make use of Experimental tools for Building Career Paths towards Innovation Startups, Employability in different mechanical trades.	2
CO 3	PO 1	Apply the knowledge of engineering fundamentals to make metal rod into given required shape according to given sketch to develop required joint.	1
	PO 5	Develop the given resources and engineering tools into required shape as given in the diagrammatical representation.	2
	PSO 3	Make use of Experimental tools for Building Career Paths towards Innovation Startups, Employability in different mechanical trades.	2
CO 4	PO 1	Apply the knowledge of engineering fundamentals to make the casting product from given materials according to given sketch to develop required shape.	1
	PO 3	Conversion of given design into a practical output using design solution for complex engineering problems and design system components.	2
	PO 11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	2
CO 5	PO 5	Develop the given resources and engineering tools into required shape as given in the diagrammatical representation.	2

	PO 11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	2
CO 6	PO 1	Apply the knowledge of engineering fundamentals to make the required electrical connection according to given circuit diagram to develop connection.	1
	PO 5	Develop the given resources and engineering tools into proper fitment as given in the diagrammatical representation.	2
	PO 11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	2
	PSO 3	Make use of Experimental tools for Building Career Paths towards Innovation Startups, Employability in different mechanical trades.	2

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES				PSO'S
	PO 1	PO 3	PO 5	PO 11	PSO 3
CO 1	1	2	2	2	2
CO 2	1	-	2	2	2
CO 3	1	-	2	-	2
CO 4	1	2	-	2	-
CO 5	-	-	2	2	-
CO 6	1	-	2	2	2

3 = High; 2 = Medium; 1 = Low

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1, PO 3, PSO 3	SEE Exams	PO 1,PO 3, PO 5, PSO 3	Seminars	-
Laboratory Practices	PO 1,PO 3, PO 5, PSO 3	Student Viva	PO 1, PO 5	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK 1	**CARPENTRY-I**
	Batch I: Preparation of Tenon joint as per given dimensions. Batch II: Preparation of Mortise joint as per given taper angle.
WEEK 2	**CARPENTRY-II**
	Batch I: Preparation of dove tail joint as per given taper angle. Batch II: Preparation of lap joint as per given dimensions.
WEEK 3	**FITTING - I**
	Batch I: Make a straight fit for given dimensions. Batch II: Make a square fit for given dimensions.
WEEK 4	**FITTING - II**
	Batch I: Make a V fit for given dimensions. Batch II: Make a semicircular fit for given dimensions.
WEEK 5	**BLACKSMITHY- I**
	Batch I: Prepare S-bend for given MS rod using open hearth furnace. Batch II: Prepare J-bend for given MS rod using open hearth furnace.
WEEK 6	**BLACKSMITHY- II**
	Batch I: Prepare Fan hook for given dimensions. Batch II: Prepare Round to Square for given dimensions.
WEEK 7	**MOULD PREPARATION-I**
	Batch I: Prepare a wheel flange mould using a given wooden pattern. Batch II: Prepare a bearing housing using an aluminum pattern.
WEEK 8	**MOULD PREPARATION-II**
	Batch I: Prepare a bearing housing using an aluminum pattern. Batch II: Prepare a wheel flange mould using a given wooden pattern.
WEEK 9	**TINSMITHY- I**
	Batch I: Prepare the development of a surface and make a rectangular tray for given dimensions. Batch II: Prepare the development of a surface and make a round tin for given dimensions.
WEEK 10	**TINSMITHY- II**
	Batch I: Prepare the development of a surface and make a Square Tin, for given dimensions. Batch II: Prepare the development of a surface and make a Conical Funnel for given dimensions.
WEEK 11	**ELECTRICAL WIRING-I**
	Batch I: Make an electrical connection of two bulbs connected in series. Batch II: Make an electrical connection of two bulbs connected in parallel.
WEEK 12	**ELECTRICAL WIRING-II**
	Batch I: Make an electrical connection of one bulb controlled by two switches connected. Batch II: Make an electrical connection of tube light.

TEXTBOOKS

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Elements of Workshop Technology, Media promoters and publishers private limited, Mumbai, Vol. I 2008 and Vol. II 2010.
2. Kalpakjian S, Steven S. Schmid, Manufacturing Engineering and Technology, Pearson Education India Edition, 4th Edition, 2002.
3. Gowri P. Hariharan, A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
4. Roy A. Lindberg, Processes and Materials of Manufacture, Prentice Hall India, 4 th Edition, 1998.
5. Rao P.N., Manufacturing Technology, Vol. I and Vol. II, Tata McGraw-Hill House, 2017

REFERENCE BOOKS:

1. Gowri P. Hariharan, A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Roy A. Lindberg, Processes and Materials of Manufacture, Prentice Hall India, 4th Edition, 1998.
3. Rao P.N., Manufacturing Technology, Vol. I and Vol. II, Tata McGraw-Hill House, 2017.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Tenon joint and Mortise joint.	CO 1, CO 2	T1:1.4, R1:1.2
2	Dove tail joint and Lap joint.	CO 1, CO 2	T1:1.5, R1:1.3
3	Straight fit and Square fit.	CO 3, CO 4	T2:12.2, R2:13.1
4	V fit and Semicircular fit.	CO 3, CO 4	T2:12.3, R2:13.4
5	S-bend and J-bend.	CO 5, CO 6	T3:9.1, R3:3
6	Fan and Round to Square shape.	CO 5, CO 6	T3:9.1, R3:3
7	Wheel flange and bearing housing.	CO 7, CO 8	T4:1.9, R2:1.8
8	Bearing housing and Wheel flange.	CO 7, CO 8	T4:2, R2:1.9
9	Rectangular tray and Round tin.	CO 9, CO 10	T5:1.4, R1:1.2
10	Make a Square Tin and Conical Funnel.	CO 9, CO 10	T5:1.7, R2:1.3
11	Series connection and parallel Connection.	CO 11, CO 12	T4:1.4, R1:1.2

12	One bulb controlled by two switches and tube light connection.	CO 11, CO 12	T5:7.1, R3:3.8

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	**Divided Tenon Joint:** It is the simplest form of Mortise and tenon joint and this joint is made by fitting a short tenon into a continuous groove. This joint has the advantage of being easy to cut and is often used to make cabinet doors and other light duty frame and panel assemblies.
2	**Cross Fitting:** It is the fundamental of type of fitting which are used fitting trade and it is formed by joining the two inclined shaped cut specimens together and is often used to join the universal bearings.
3	**Hexagonal Headed Bolt:** Hexagonal bolts are large bolts with a six-sided head used to fasten wood to wood, or metal to wood. These will have a tendency to spin as you tighten them.
4	**Open scoop:** Open scoop is used for accurately dispensing powders and granules hygienically. It is suitable for any hygienic application.
5	**T-Pipe Joint:** T-pipe is a type of fitting which is T-shaped having two outlets at 90 degrees to the main line. It is short piece of pipe with a lateral outlet.it is widely used as pipe fittings.
6	**Grooved Pulley:** Grooved pulley often used to for holding a belt, wire rope or rope and incorporated into a pulley. These sheave pins on a axle or bearing inside the frame of the pulley. This allows wire or rope to move freely, minimizing friction and wear on the cable.
7	**Bell Indicator circuit:** Bell indicator circuit is used where a bell and buzzers are needed to control from different locations. Bell indicator circuit is also known as hoteling circuit where an electric bell is controlled from more than one locations.

Signature of Course Coordinator **HOD,AE**
Mr.Gooty Rohan, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE ENGINEERING
COURSE DESCRIPTION

Course Title	BASIC ELECTRICAL ENGINEERING LABORATORY				
Course Code	AEEC04				
Program	B.Tech				
Semester	I	CSE/CSE(AI&ML)/CSE(CS)/CS&IT/CSE(DS)/IT			
Course Type	Foundation				
Regulation	IARE - R20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Ms. T Saritha Kumari, Associate Professor				

I COURSE OVERVIEW:

The objective of the Basic Electrical Engineering Laboratory lab is to expose the students to the electrical circuits and give them experimental skill. The purpose of lab experiment is to continue to build circuit construction skills using different circuit element. It provides hands-on experience by examining the electrical characteristics of various AC and DC machines.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	AHSC02	I	Linear ALgebra and Calculus

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Basic Electrical Engineering Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

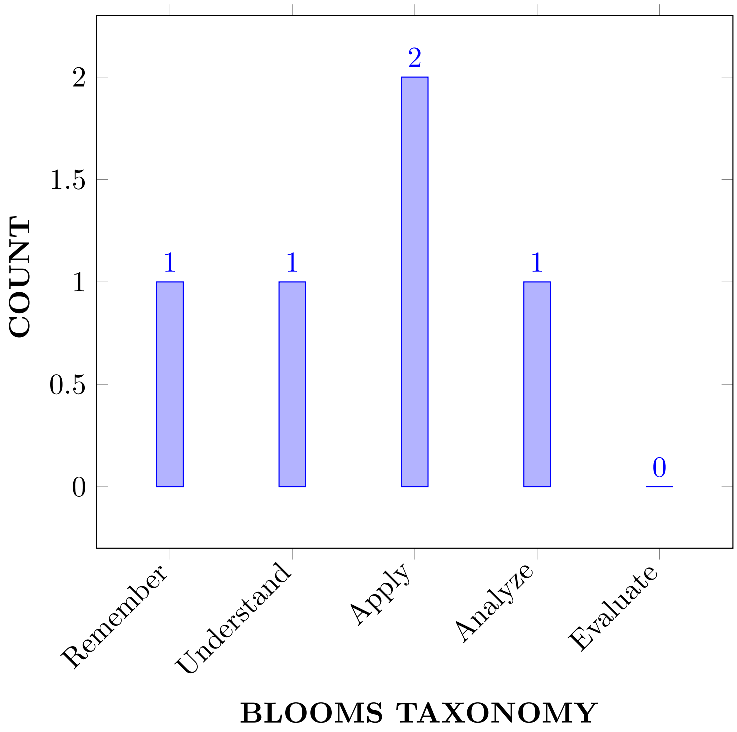
I	The basic laws, network reduction techniques and theorems for different circuits.
II	The performance characteristics of AC series and parallel circuits for measurement of electrical quantities using digital simulation tools.
III	The elementary experimental and modelling skills for handling problems with electrical machines in the industries and domestic applications to excel in professional career.
IV	The intuitive knowledge needed to test and analyse the performance leading to design of electric machines by conducting various tests and calculate the performance parameters.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Analyze** an electric circuit using Ohm's and Kirchhoff's laws, nodal and mesh analysis.	Analyze
CO 2	**Apply** various network theorems for reducing complex networks into simple equivalent network.	Apply
CO 3	**Examine** the alternating quantities for different periodic wave forms and the passive networks.	Understand
CO 4	**Analyze** the performance characteristics of DC shunt machine at various loading conditions.	Analyze
CO 5	**Examine** the performance of single-phase transformers, induction motors and alternator by conducting a suitable test.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Laboratory experiments, internal and external lab exam

PO 5	**Modern Tool Usage:** Create,select and apply appropriate techniques,resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of limitation.	1	Laboratory experiments, internal and external lab exam
PO 8	**Ethics:** Apply ethical principles and commit to professikonal ethics and responsibilties and norms of the engineering practice.	3	Laboratory experiments, internal and external lab exam
PO 9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	Laboratory experiments, internal and external lab exam
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	Laboratory experiments,internal and external lab exam
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Laboratory experiments, internal and external lab exam

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Recollect the concept of electricity is described through scientific principles, importance Kirchhoff laws in relation with law of conservation of energy and charge circuits are explained using **knowledge of mathematics, science and engineering fundamentals.** and various source transformation techniques are adopted for solving complex circuits.	3
	PO 5	Create,select and apply appropriate techniques,resources and modern engineering and IT tools **in solving the circuits**	1
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **in solving the circuits**	1
	PO 9	Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **in solving the circuits**.	3
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society **in solving the circuits**.	5
	PO 12	The preparation and ability to engage in independent and life-long learning in the broadest context of technological change **in solving the circuits**.	3
	PSO 1	Solve complex electrical circuits by applying basic circuit concepts **by using computer programs.**	1
CO 2	PO 1	Demonstrate the various network theorems in order to determine the same **using principles of mathematics, science and engineering fundamentals.**	3
	PO 5	Create,select and apply appropriate techniques,resources and modern engineering and IT tools **in solving the complex circuits**	1
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **in solving complex circuits by using theroems**	1
	PO 9	Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **in solving complex circuits by using theroems**	3
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society **in solving complex circuits by using theroems**	5
	PO 12	The preparation and ability to engage in independent and life-long learning in the broadest context of technological change **in solving the circuits by using theroems**	3

	PSO 1	Simplify complex electrical networks by applying various circuit theorems **by using computer programs.**	1
CO 3	PO 1	Understand the concept of alternating quantities with peak, average and root mean square values for different periodic wave forms and impedance of series RC,RL and RLC circuits by **knounderstanding and applying the fundamentals of mathematics, science and engineering.**	3
	PO 5	Create,select and apply appropriate techniques,resources and modern engineering and IT tools **in solving the circuits**	1
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **in understanding concept of alternating quantities with peak, average and root mean square values for different periodic wave forms and impedance of series RC,RL and RLC circuit**	1
	PO 9	Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **in understanding concept of alternating quantities with peak, average and root mean square values for different periodic wave forms and impedance of series RC,RL and RLC circuits**	3
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society **in understanding concept of alternating quantities with peak, average and root mean square values for different periodic wave forms and impedance of series RC,RL and RLC circuits**	5
CO 4	PO 1	Apply (knowledge) magnetization characteristics DC shunt generator and performance characteristics of DC shunt machine by **analyzing complex engineering problems using the principles of mathematics, engineering science.**	3
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **in applying magnetization characteristics DC shunt generator and performance characteristics of DC shunt machine**	1
	PO 9	Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **in applying magnetization characteristics DC shunt generator and performance characteristics of DC shunt machine**	3
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society **in applying magnetization characteristics DC shunt generator and performance characteristics of DC shunt machine**	5

CO 5	PO 1	Understand the performance characteristics of transformer, Imduction motors and alternator by using principles of **mathematics and engineering science**	3
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **by understanding the performance characteristics of transformer, Imduction motors and alternator**	1
	PO 9	Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **by understanding the performance characteristics of transformer, Imduction motors and alternator**	3
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society **by understanding the performance characteristics of transformer, Imduction motors and alternator**	5
	PSO 1	Understand the performance characteristics of transformer, Imduction motors and alternator **by using computer programs.**	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES					PROGRAM SPECIFIC OUTCOMES
	PO 1	PO 8	PO 9	PO10	PO12	PSO1
CO 1	3	3	3	3	3	1
CO 2	3	3	3	3	3	1
CO 3	3	3	3	3		
CO 4	3	3	3	3		
CO 5	3	3	3	3		1

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**OHM'S LAW, KVL AND KCL**
	Verification of Ohm's, Verification of Kirchhoff's current law and Voltage law using hardware and digital simulation.
WEEK II	**MESH ANALYSIS**
	Determination of mesh currents using hardware and digital simulation
WEEK III	**NODAL ANALYSIS**
	Measurement of nodal voltages using hardware and digital simulation.
WEEK IV	**IMPEDANCE OF SERIES RL AND RC CIRCUIT**
	Examine the impedance of series RL and RC circuit using hardware and digital simulation
WEEK V	**IMPEDANCE OF SERIES RLC CIRCUIT**
	Measure the impedance of series RLC Circuit using hardware and digital simulation.
WEEK VI	**SINGLE PHASE AC CIRCUITS**
	Determination of average value, RMS value, form factor, peak factor of sinusoidal wave using digital simulation.
WEEK VII	**SUPERPOSITION AND MAXIMUM POWER TRANSFER THEOREM**
	Verification of superposition and maximum power transfer theorem using hardware and digital simulation.
WEEK VIII	**THEVENIN'S AND NORTON'S THEOREM**
	Verification of Thevenin's and Norton's theorem using hardware and digital simulation.
WEEK IX	**SWINBURNE'S TEST**
	Predetermination of efficiency of DC shunt machine.
WEEK X	**MAGNITETIZATION CHARACTERISTICS**
	Determine the critical field resistance from magnetization characteristics of DC shunt generator.
WEEK XI	**BRAKE TEST ON DC SHUNT MOTOR**
	Study the performance characteristics of DC shunt motor by brake test
WEEK XII	**SPEED CONTROL OF DC SHUNT MOTOR**
	Verify the armature and field control techniques of DC shunt motor.
WEEK XIII	**OPEN CIRCUIT AND SHORT CIRCUIT TEST ON SINGLE PHASE TRANSFORMER**

	Determination of losses and efficiency of single-phase transformer.
WEEK XIV	**SYNCHRONOUS IMPEDENCE METHOD**
	Determine the regulation of alternator using synchronous impedance method.

TEXTBOOKS

1. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 20103

2. P S Bimbhra, "Electrical Machinery", Khanna Publishers, 1 st Edition,2011.

REFERENCE BOOKS:

1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6th Edition, 2006.

2. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.

3. Etter, "Introduction to MATLAB 7", Pearson Education, 1st Edition, 2008.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Verification of Ohm's, Verification of Kirchhoff's current law and voltage law using hardware.	CO 1	T1:1.1
2	Determination of mesh currents using hardware.	CO 2	T1:2.1
3	Measurement of nodal voltages using hardware.	CO 2	T1:2.4
4	Examine the impedance of series RL and RC circuit.	CO 3	T1:6.1
5	Measure the impedance of series RLC Circuit using hardware.	CO 3	T1:4.6
6	Determination of average value, RMS value, form factor, peak factor of sinusoidal wave.	CO 3	T1:5.1
7	Verification of superposition and maximum power transfer theorem using hardware and digital simulation.	CO 2	R3: T1:4.1
8	Verification of Thevenin's and Norton's theorem using hardware.	CO 2	T1:4.7
9	Predetermination of efficiency of DC shunt machine.	CO 4	T2:4.11
10	Determine the critical field resistance from magnetization characteristics of DC shunt generator.	CO 4	T2:4.11
11	Study the performance characteristics of DC shunt motor by brake test.	CO 4	T2:4.12
12	Speed control of DC shunt motor.	CO 4	T2:4.14
13	Determination of losses and efficiency of single-phase transformer.	CO 5	T2:1.1
14	Determine the regulation of alternator using synchronous impedance method.	CO 5	T2:5.4

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Verification of reciprocity theorem.
2	Determination of efficiency by load test in DC shunt generator.
3	Determination of efficiency by load test on DC series generator.
4	Determination of efficiency by load test on DC compound generator.
5	Determination of efficiency by load test on a single-phase transformer

Signature of Course Coordinator **HOD,CSE**
Mrs. T Saritha Kumari, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE ENGINEERING**				
Course Title	**ENGLISH**				
Course Code	AHSC01				
Program	B. Tech				
Semester	II				
Course Type	Foundation				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	2	-	2	-	-
- Course Coordinator	Dr. M.Sailaja, Associate Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	-

II COURSE OVERVIEW:

The principle aim of the course is that the students will have awareness about the importance of English language in the contemporary times and also it emphasizes the students to learn this language as a skill (listening skill, speaking skill, reading skill and writing skill). Moreover, the course benefits the students how to solve their day-to-day problems in speaking English language. Besides, it assists the students to reduce the mother tongue influence and acquire the knowledge of neutral accent. The course provides theoretical and practical knowledge of English language and it enables students to participate in debates about informative, persuasive, didactic, and commercial purposes.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
English	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	LCD / PPT	x	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	✓	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
37%	Remember
63 %	Understand
-	Apply
-	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

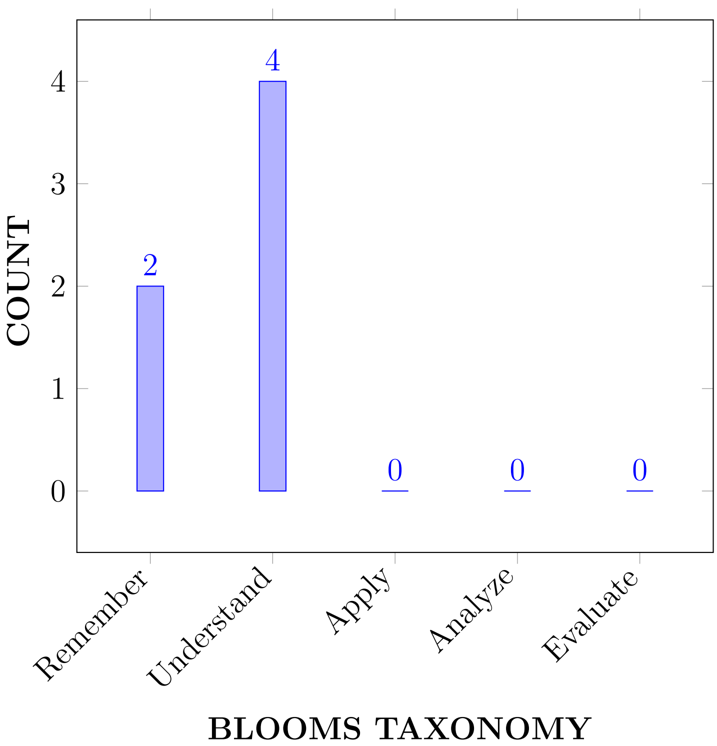
I	Standard pronunciation, appropriate word stress, and necessary intonation patterns for effective communication towards achieving academic and professional targets.
II	Appropriate grammatical structures and also using the nuances of punctuation tools for practical purposes.
III	A critical aspect of speaking and reading for interpreting in-depth meaning between the sentences.
IV	A conceptual awareness on writing in terms of unity, content, coherence, and linguistic accuracy.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Discuss** the prime necessities of listening skill for academic and non-academic purposes.	Remember
CO 2	**Illustrate** appropriate speaking strategies to explain a topic in a clear-cut manner.	Understand
CO 3	**Choose** acceptable language for developing life skills to overcome the challenges at professional platform.	Understand
CO 4	**Interpret** the grammatical aspects effectively in speaking and writing at functional usage.	Understand
CO 5	**Describe** the importance of reading skill and various strategies to enhance professional growth and success.	Remember
CO 6	**Summarize** writing skills for fulfilling the academic and non-academic requirements of various written communicative functions.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 10	**Communication :** Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (Communication). "Students should demonstrate the ability to communicate effectively in writing / Orally." 1. Clarity (Writing); 2. Grammar/Punctuation (Writing); 3. References (Writing); 4. Speaking Style (Oral); 5. Subject Matter (Oral).	5	Seminar/ Conferences/ Research Papers IE/AAT / Discussion

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	-	-
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	✓-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 10	Discuss the heeds of functional grammar and punctuation tools in speaking and writing by generating the clarity of an audio text.	5
CO 2	PO 10	Illustrate essential aspects of grammar as well as punctuation marks for speaking or writing towards a discussion on a topic to give the clarity.	5
CO3	PO 10	Choose suitable grammatical structures and punctuation marks at speaking and writing areas maintaining clarity at professional platform.	5
CO4	PO 10	Interpret the grammatical knowledge and punctuation marks systematically towards providing the clarity in speaking and writing.	5
CO5	PO 10	Demonstrate the role of grammar and punctuation marks understanding the meaning between the sentences as well as paragraphs in speaking or writing for a clarity.	5
CO6	PO 10	Describe the clarity of grammatical usage and the obligation of punctuation marks in speaking and writing.	5

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 4	-	-	-	-		-	-	-	-	5	-		-	-	-
CO 5	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	5	-		-	-	- -

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	100	-		-	-	-
CO 2	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-
CO 3	-		-	-	-	-	-	-	-	100	-	-	-	-	-
CO 4	-	-	-	-		-	-	-	-	100	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	100	-	-	- -	-	-
CO 6	-	-	-	-		-	-	-	-	100	-		-	-	- -

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 $\leq$ C$\leq$ 5% – No correlation
1 -5 <C$\leq$ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% $\leq$ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-
AVERAGE	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	✓
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**GENERAL INTRODUCTION AND LISTENING SKILL**
	Introduction to communication skills; Communication process; Elements of communication; Soft skills vs. hard skills; Importance of soft skills for engineers; Listening skills; Significance; Stages of listening; Barriers and effectiveness of listening; Listening comprehension.
MODULE II	**SPEAKING SKILL**
	Significance; Essentials; Barriers and effectiveness of speaking; Verbal and non-verbal communication. Generating talks based on visual prompts; Public speaking; Exposure to structured talks; Addressing a small group or a large formal gathering; Oral presentation; Power point presentation.
MODULE III	**VOCABULARY AND GRAMMAR**
	The concept of Word Formation; Root words from foreign languages and their use in English; Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms; Antonyms; Standard abbreviations; Idioms and phrases; One-word substitutes Sentence structure; Uses of phrases and clauses; Punctuation; Subject verb agreement; Modifiers; Articles; Prepositions.
MODULE IV	**READING SKILL**
	Significance, Techniques of reading, Skimming-Reading for the gist of a text, Scanning - Reading for specific information, Intensive, Extensive reading, Reading comprehension, Reading for information transfer, Text to diagram, Diagram to text.
MODULE V	**WRITING SKILL**
	Significance; Effectiveness of writing; Organizing principles of Paragraphs in documents; Writing Introduction and conclusion; Techniques for writing precisely, Letter writing; Formal and Informal letter writing, E-mail writing, Report Writing.

TEXTBOOKS

1. Handbook of English (Prepared by the faculty of English, IARE).

REFERENCE BOOKS:

1. 1. Norman Whitby, Business Benchmark: Pre-Intermediate to Intermediate – BEC Preliminary, Cambridge University Press, 2nd Edition,2008.
2. Devaki Reddy, Shreesh Chaudhary, Technical English, Macmillan, 1st Edition,2009.
3. Rutherford, Andrea J, Basic Communication Skills for Technology, Pearson Education,2nd Edition, 2010.
4. Raymond Murphy, Essential English Grammar with Answers, Cambridge University Press, 2nd Edition,2010.
5. Dr. N V Sudershan, President Kalam's Call to the Nation, Bala Bharathi Publications, Secunderabad, 1st Edition,2003

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Discussion on mapping COs with POs. (OBE)		
CONTENT DELIVERY (THEORY)			
2	Introduction to communication skills.	CO 1	T1:06.06
3	Communication process.	CO 1	T1:06.09
4	Soft skills vs hard skills.	CO 3	T1:09.10
5	Significance of LSRW skills.	CO 1	T1:10.11
6	Significance of listening skill.	CO 1	TI:12.16
7	Different stages of listening.	CO 1	T1:16.18
8	Barriers of listening skill.	CO 1	TI:18.21
9	Different types of listeners.	CO 1	TI:21.22
10	Effectiveness of listening skill.	CO 1	T1:22.24
11	Phonetics: Listening to the sounds of English language.	CO 1	T1:24.29
12	Introduction to speaking skills.	CO 2	T1:30.32
13	Effectiveness of speaking skills.	CO 2	T1:33.34
14	Verbal and non-verbal communication.	CO 2	T1:34.35
15	Generating talks based on visual or written prompts.	CO 2	T1:36.37
16	Developing public speaking skills.	CO 2	T1:38.39
17	Oral presentation with power-point.	CO 3	TI:39.42
18	The concept of word formation.	CO 4	T1:43.100
19	Antonyms and synonyms.	CO 4	TI:49.56
20	Idioms and phrases.	CO 4	TI:57.60
21	One-word substitutes.	CO 4	TI:60.62
22	Root words from foreign languages and their usage in English.	CO 4	TI:60.62
23	Sentence structure.	CO 4	T1:58.62
24	Punctuation tools and their role in a language.	CO 4	TI:63.66
25	Subject-verb agreement.	CO 4	TI:66.69
26	Usage of Adjectives.	CO 4	TI:70.73
27	Significance of articles and their usage.	CO 4	TI:74.75
28	The usage of prepositions.	CO 4	T1:76.77
29	Significance of reading skill.	CO 5	T1:78.79
30	Different techniques of reading skill.	CO 6	T1:80.82
31	How to Read Your Textbook More Efficiently.	CO 6	TI:83.85
32	Different types of reading comprehension.	CO 6	TI:85.86
33	Reading for information transfer.	CO 6	TI:85.96
34	Significance and effectiveness of writing skill.	CO 6	TI:96.98

35	Organizing principles of a paragraph in documents and types of paragraphs.	CO 5	T1:101.103
36	Writing introduction and conclusion.	CO 5	T1:103.103
37	Techniques for writing precis.	CO 8	T1:103.103
38	Introduction to informal letters.	CO 7	TI:105.108
39	Introduction to formal letters.	CO 7	TI:109.110
40	Introduction of email writing and formal and informal emails.	CO 7	TI:111.112
41	Significance of Report Writing.	CO 8	TI: 113. 114
PROBLEM SOLVING/ CASE STUDIES			
42	The aspects to improve listening comprehension Discuss in detail.	CO 1	TI:10,11
43	Different types of listeners with examples.	CO 1	TI: 19,21
44	The sounds of English language	CO 1	TI:23,27
45	verbal communication or written communication.	CO 2	TI: 27,30
46	Various difficulties in public speaking.	CO 2	TI: 32,33
47	Different ways of greeting people in formal and informal situation and discuss how do they matter in communication?	CO 2	TI: 35,37
48	'Oral presentation requires a good planning'.	CO 2	TI:36,38
49	Power point presentation and the ways to make Power point presentation.	CO 2	TI: 37,38
50	Methods that are used to establish the process of building vocabulary with examples from the most used words in spoken English.	CO 4	TI:39,41
51	The usage of idioms and phrases in spoken English.	CO 4	TI: 47,50
52	'Structure proposition-evaluation' -Reading technique.	CO 5	TI:56,58
53	Active reading, detailed reading, and speed-reading techniques used in different situations.	CO 5	TI: 79,81
54	The elements of paragraph writing in detail.	CO 8	TI:100,102
55	Logical bridges and Verbal bridges in writing.	CO 8	TI:102,104
56	Soft skills and Interpersonal Communication.	CO 8	TI:102,104
DISCUSSION OF DEFINITION AND TERMINOLOGY			
57	Soft skills and Interpersonal Communication.	CO 1	TI 8,9
58	Language acquisition is a process.	CO 1	TI: 11,12
59	Communication.	CO 1	TI: 14,16
60	Time management.	CO 3	TI:9,10
61	Stress management.	CO 3	TI:9,10
DISCUSSION OF QUESTION BANK			
62	Soft Skills for difficult situations in terms of reassurance and reliability.	CO 3	TI:9,10
63	Verbal and non-verbal communication.	CO 2	TI: 34,35
64	Honesty, Respect, Self-Control and Accountability their role in building long lasting interpersonal skills?	CO 3	TI: 9,10

65	Etiquette and manners. Its importance in social, personal and professional communication.	CO 23	TI: 9,10
66	Problem solving and decision making.	CO 3	TI: 9,10

Signature of Course Coordinator **HOD**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**
Course Title	**APPLIED PHYSICS**
Course Code	**AHSC09**
Program	**B. Tech.**
Semester	**II**
Course Type	**FOUNDATION**
Regulation	UG-20

<table>
<tr><td rowspan="3">Course Structure</td><td colspan="3">Theory</td><td colspan="2">Practical</td></tr>
<tr><td>Lecture</td><td>Tutorials</td><td>Credits</td><td>Laboratory</td><td>Credits</td></tr>
<tr><td>3</td><td>-</td><td>4</td><td>3</td><td>1.5</td></tr>
<tr><td>Course Coordinator</td><td colspan="5">Dr. N. Shankaraiah, Associate Professor.</td></tr>
</table>

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
10+2	-	-	Basic Principles of Semiconductors

II COURSE OVERVIEW:

This course is structured specifically to make the students understand some of the core topics in physics essential for further studies in engineering. It focuses on illustrating and developing an understanding of the interplay between problem solving and their practical applications which include experimental techniques and modern equipment. The topics include quantum mechanics, semiconductors, opto-electronic devices, magnetism, dielectrics, LASER and fiber optics. At the end, this course helps students to appreciate the diverse real-time applications in technological fields in respective branches.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Applied Physics	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

<table>
<tr><td>✓</td><td>Power Point Presentations</td><td>✓</td><td>Chalk & Talk</td><td>x</td><td>Assignments</td><td>x</td><td>MOOC</td></tr>
<tr><td>✓</td><td>Open Ended Experiments</td><td>x</td><td>Seminars</td><td>x</td><td>Mini Project</td><td>✓</td><td>Videos</td></tr>
<tr><td>x</td><td colspan="7">Others</td></tr>
</table>

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Percentage of Cognitive Level	Blooms Taxonomy Level
0 %	Remember
60 %	Understand
40 %	Apply
0 %	Analyze

Table 1: The expected percentage of cognitive level of questions in SEE

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 2), with 20 marks for Continuous Internal Examination (CIE), 10 marks for Alternative Assessment Tool (AAT) (Table 3).

<table>
<tr><th colspan="2">Component</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td rowspan="4">CIA</td><td>Continuous Internal Examination – 1 (Mid-term)</td><td>10</td><td rowspan="4">30</td></tr>
<tr><td>Continuous Internal Examination – 2 (Mid-term)</td><td>10</td></tr>
<tr><td>AAT-1</td><td>5</td></tr>
<tr><td>AAT-2</td><td>5</td></tr>
<tr><td>SEE</td><td>Semester End Examination (SEE)</td><td>70</td><td>70</td></tr>
<tr><td colspan="3">Total Marks</td><td>100</td></tr>
</table>

Table 2: Assessment pattern for CIA

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT):
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table 3.

Concept Video	Tech-talk	Complex Problem Solving
50%	50%	-

Table 3: Assessment pattern for CIA

VI COURSE OBJECTIVES:

The students will try to learn:

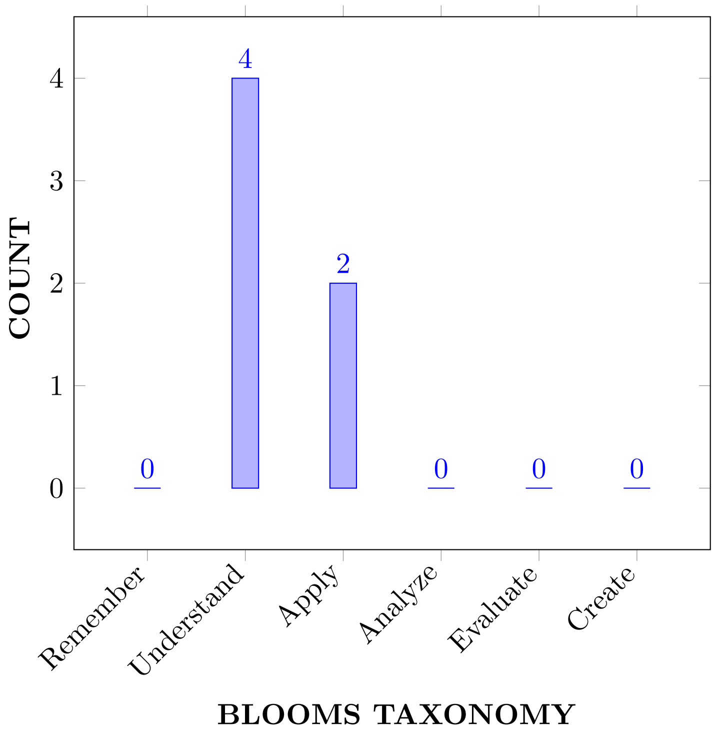
I	Basic formulations in wave mechanics for the evolution of energy levels and quantization of energies for a particle in a potential box with the help of mathematical description.
II	Fundamental properties of semiconductors including the band gap, charge carrier concentration, doping and transport mechanisms.
III	The metrics of optoelectronic components, LASER, optical fiber communication and be able to incorporate them into systems for optimal performance.
IV	The appropriate magnetic and dielectric materials required for various engineering applications.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Apply** the concepts of dual nature of matter and Schrodinger wave equation to a particle enclosed in simple systems.	Apply
CO 2	**Demonstrate** the classification of Solids and important aspects of semiconductors in terms of carrier concentration and Fermi level.	Understand
CO 3	**Make use of** the key concepts of semiconductors to explain the basic working mechanism of optoelectronic device characteristics of light-emitting diodes, photodetectors and solar cells.	Apply
CO 4	**Illustrate** the properties of dielectric and magnetic materials suitable for engineering applications.	Understand
CO 5	**Compare** the concepts of LASER and normal light in terms of mechanism and working principles for applications in different fields and scientific practices.	Understand
CO 6	**Explain** functionality of components in optical fiber communication system by using the basics of signal propagation, attenuation and dispersion.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Program Outcomes	
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems..	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Seminar

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	-	-

PSO3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	1	AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH POs, PSOs:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	✓	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	✓	-	✓	-	-	-	-	-	-	-	-	-	-	✓
CO 5	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-

XII JUSTIFICATIONS FOR CO – (PO/PSO) MAPPING -DIRECT:

Course Outcomes	POs PSOs	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	**Outline** drawbacks of classical mechanics, basic principles **dual nature** of matter wave, **derive** mathematical wave equation of matter waves and come to **conclusion** of quantization of energy used in quantum dots.	3
	PO 2	**Explain** the given **problem statement** and formulate quantum confinement problems related to particle enclosed in small dimension from the provided **information** and **data** in reaching substantial conclusions by the **interpretation of results**.	4
CO 2	PO 1	**Illustrate** the charge transport mechanism in intrinsic and extrinsic semiconductors using energy level diagrams, calculate their charge carrier concentration and use those expressions to integrate with other engineering disciplines .	3
	PO 4	**Identify** the use of these semiconductors under study and their conduction mechanism for the **research based knowledge** and **technological development**.	2
	PO 2	**Explain** the given **problem statement** and formulate mobility and conductivity aspects of a material from the provided **information** and **data** in reaching substantial conclusions by the **interpretation of Hall coefficient value**.	4
CO 3	PO 1	**Acquire** detailed **knowledge** of fundamental and applied aspects of optoelectronic device physics, **analyze** key parameters and **apply** them to the functioning of electronic devices.	3

Course Outcomes	POs PSOs	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 2	**Illustrate** the given **problem statement** and **formulate** light interaction aspects of direct band gap materials from the provided **information** and **data** by the **interpretation of carrier generation and recombination** in opto-electronic devices	4
CO 4	PO 1	**Relate** principles of different types of polarization mechanism and expression for polarizability to the properties of functional materials and for solving engineering problems by applying these principles of science.	3
	PO 2	**Explain** the given **problem statement** and **formulate** polarization versus applied electric field related to ferroelectric materials from the provided **information** and **data** by the **interpretation of hysteresis loop**.	4
	PO 1	**Utilize** spin and orbital motion of electrons in determining **magnetic moment** of materials in terms of Bohr magneton materials having specific **engineering applications**.	3
	PO 4	**Identify** the use of magnetic materials and their magnetization values for the **research based knowledge** and **technological development.**	2
	PSO 3	**Make use of** modern computer tools to determine remnant magnetization and coercivity values from B-H curve and gain knowledge helpful for **higher studies**.	1
CO 5	PO 1	**Compare** the concepts of LASER and normal light in terms of mechanism and **working principle** for applications in different fields and scientific practices.	3
CO 6	PO 1	**Explain** functionality of components in optical fiber communication **system** by using the **basics** of signal propagation, attenuation and dispersion.	3
	PO 2	**Identify the given problem** and **formulate** expressions for acceptance angle and numerical aperture with the given **information** and **data** by applying principles of information propagation through optical waveguides.	4

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO/PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	4	-	2	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	4	-	-	-	-	-	-	-	-	-		-	-	-
CO 4	3	4	-	2	-	-	-	-	-	-	-	-	-	-	1

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO/PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	40	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	100	40	-	20	-	-	-	-	-	-	-	-	-	-	-
CO 3	100	40	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	100	40	-	20	-	-	-	-	-	-	-	-	-	-	30
CO 5	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	100	40	-	-	-	-	-	-	-	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (CO-PO/PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.
0 - 0≤ C≤ 5% – No correlation
1-5 <C≤ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	-	1		-	-	-	-	-	-		-	-	-
CO 3	3	2	-	-	-	-	-	-	-	-	-		-	-	-
CO 4	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
CO 5	3		-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	18	10	-	2	-		-	-	-	-	-	-	-	-	-
AVERAGE	3	2	-	1	-		-	-	-	-	-	-	-	-	1

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	-				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

x	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**QUANTUM MECHANICS**
	Introduction to quantum physics, de broglie hypothesis, Wave-particle duality, Davisson and Germer's experiment, Time-independent Schrödinger equation for wave function, Physical significance of the wave function, Schrödinger equation for one dimensional problems - particle in a box.
MODULE II	**INTRODUCTION TO SOLIDS AND SEMICONDUCTORS**
	Introduction to classical free electron theory and quantum theory, Bloch's theorem for particles in a periodic potential (Qualitative treatment), Kronig-Penney model (Qualitative treatment), classification: metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Carrier concentration, Dependence of Fermi level on carrier-concentration and temperature, Hall effect.
MODULE III	**SEMICONDUCTOR DEVICES**
	Direct and indirect band gaps, p-n junction, V-I characteristics, Energy Band diagram, Biasing of a junction, Zener diode. Construction and working of LED, Photo detectors, PIN, Avalanche photodiode, Solar cell.
MODULE IV	**ENGINEERED ELECTRIC AND MAGNETIC MATERIALS**
	Polarisation, Permittivity, Dielectric constant, Internal field in solids, Clausius Mosotti equation, Electronic, Ionic and Orientational polarization (Qualitative) Ferroelectricity;Magnetisation, Permeability, Susceptibility, Classification of dia, para and ferro magnetic materials on the basis of magnetic moment, Hysteresis curve.
MODULE V	**LASERS AND FIBER OPTICS**
	Characteristics of LASER, Spontaneous and stimulated emission of radiation, Metastable state, Population inversion, Lasing action, Ruby LASER, He-Ne LASER and applications of LASER.Principle and construction of an optical fibre, Acceptance angle, Numerical aperture, Types of optical fibers (Single mode, multimode, step index, graded index), Optical fibre communication system with block diagram and Application of optical fibres.

TEXTBOOKS

1. Dr. K Vijay Kumar and Dr. S Chandralingam — Modern Engineering Physics‖ Volume-1 & 2, S Chand. Co, 2018.
2. Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar —A Text Book of Engineering Physics‖, S. Chand.
3. B. K Pandey and S. Chaturvedi —Engineering physics‖, Cengage learning.

REFERENCE BOOKS:

1. J. Singh, ―Semiconductor Optoelectronics: Physics and Technology‖, McGraw-Hill Inc. (1995).
2. P. Bhattacharya, ―Semiconductor Optoelectronic Devices‖, Prentice Hall of India (1997).
3. Monica Katiyar and Deepak Gupta on NPTEL.Online course: "Optoelectronic Materials and Devices".

WEB REFERENCES

1. http://link.springer.com/book
2. http://www.thpys.physics.ox.ac.uk
3. http://sciencedirect.com/science
4. http://www.e-booksdirectory.com

COURSE WEB PAGE:

1. https://lms.iare.ac.in/index?route=course/details & course_id=17

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping		
CONTENT THEORY(DELIVERY)			
2	Introduction to Quantum Physics	CO 1	T2:5.15; R1:1.16
3	Wave-Particle duality of radiation	CO 1	T2:5.17; R1:1.13.1
4	De-broglie hypothesis and de-broglie wavcelength	CO 1	T2:5.18; R1:1.13.2
5	Properties of Matter waves	CO 1	T2:5.19 R1:1.13.3,
6	Davisson and Germer's experiment	CO 2	T2:5.20; R1:1.17.1
7	Schrödinger time independent wave equation	CO 1	T2:5.24; R1:1.17.3
8	Physical significance of wavefunction	CO 1	T2:6.1; R1:2.3
9	Particle in a one dimensional potential box	CO 1	T2:6.3; R1:2.6.1
10	Free electron theory and Quantum theory of solids, Electron in a Periodic potential – Bloch's theorem	CO 2	T2:6.5; R1:2.6.2

11	Kronig-Penney model, Band theory of solids	CO 2	T2:7.3; R1:2.8
12	Origin of energy bands in solids, Classification of solids into insulators, conductors and semiconductors	CO 2	T2:7.5,7.6; R1:2.9.2
13	Introduction to intrinsic and extrinsic semiconductors, Intrinsic carrier concentration	CO 2	T2:7.7; R1:2.10
14	Carrier concentration and Fermi level in p-type semiconductors	CO 2	T2:7.7; R1:2.10
15	Carrier concentration and Fermi level in n-type semiconductors	CO 2	T2:7.11; R2:2.10.2
16	Hall effect and its applications	CO 2	T2:7.11; R2:2.32
17	Direct and indirect band gaps	CO 3	T2:7.11; R2:2.10
18	p-n junction, V-I characteristics	CO 3	T2:7.12; R2:2.10.3
19	Energy Band diagram of PN Junction	CO 3	T2:7.12; R2:2.10.3
20	Biasing of PN junction	CO 3	T2:7.13; R1:2.10.4
21	Zener diode	CO 3	T2:7.14 R1:2.10.6
22	Construction and working of LED	CO 3	T2:7.15; R1:2.10.7
23	Construction and working of Photodiode, PIN and Avalanche Photodiode	CO 3	T1:7.15; R2:2.10.7
24	Construction and working of Solar cell	CO 3	T1:7.15; R2:2.10.7
25	Introduction to dielectric materials, Polarization, Permittivity, Dielectric constant	CO 4	T1:7.15; R2:2.10.7
26	Internal fields in solids	CO 4	T1:16.9 R2:8.11.1
27	Clausius – Mosotti equation	CO 4	T1:16.9; R2:8.11.2
28	Ionic, Electronic and Orientational polarization	CO 4	T1:15.2; R4:8.2
29	Ferroelectricity	CO 4	T2:15.7; R4:8.3.3
30	Magnetic materials, Magnetization, Permeability, Susceptibility	CO 4	T2:15.13 R4:8.7.2
31	Diamagnetic and Paramagnetic materials	CO 4	T2:15.13; R4:8.7.2
32	Ferromagnetic materials	CO 4	T2:15.16; R1:8.7.3
33	Hysteresis curve	CO 4	T1:11.9; R2:12.24

34	Characteristics of LASER, Spontaneous and Stimulated emission	CO 5	T1:11.9; R3:12.25
35	Metastable state, Population inversion, Lasing action	CO 5	T1:3.2; R3:3.2
36	Ruby LASER	CO 5	T1:3.3.1; R3:3.2
37	He-Ne LASER, Applications of LASER	CO 5	T2:16.5; R3:8.10
38	Principle and construction of optical fibers	CO 6	T2:16.5; R3:8.10
39	Acceptance angle, Acceptance cone, Numerical Aperture	CO 6	T1:3.3.1; R3:3.2
40	Types of optical fibers	CO 6	T2:16.5; R3:8.10
41	Optical fiber communication system, Applications of optical fibers	CO 6	T2:16.5; R3:8.10
PROBLEM SOLVING			
1	De-broglie wavelength	CO 1	T1:3.3.1; R3:3.2
2	Energies associated with one dimensional potential box	CO 1	T2:16.5; R3:8.10
3	Intrinsic carrier concentration, Fermi level in semiconductors	CO 2	T2:16.5; R3:8.10
4	Carrier concentration based on Hall coefficient	CO 2	T1:3.3.1; R3:3.2
5	Mobility and conductivity based on Hall coefficient	CO 2	T2:16.5; R3:8.10
6	Diffusion and drift	CO 3	T2:16.5; R3:8.10
7	Energy gap in indirect bandgap semiconductors	CO 3	T1:3.3.1; R3:3.2
8	Dielectric constant, capacitance, permittivity	CO 4	T2:16.5; R3:8.10
9	Electric susceptibility, Polarization vector	CO 4	T2:16.5; R3:8.10
10	Polarizability	CO 4	T1:3.3.1; R3:3.2
11	Magnetic moment, Magnetic induction, Permeability	CO 4	T2:16.5; R3:8.10
12	Intensity of magnetization, Magnetic susceptibility	CO 4	T2:16.5; R3:8.10
13	Wavelength and Energy bandgap, Divergence	CO 5	T2:16.5; R3:8.10
14	Relative population of two states, Number of photons emitted	CO 5	T1:3.3.1; R3:3.2

15	Acceptance angle and Numerical Aperture	CO 6	T2:16.5; R3:8.10
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Quantum Mechanics	CO 1	T2:16.5; R3:8.10
2	Introduction to Solids and Semiconductors	CO 2	T1:3.3.1; R3:3.2
3	Semiconductor devices	CO 3	T2:16.5; R3:8.10
4	Engineered electric and magnetic materials	CO 4	T2:16.5; R3:8.10
5	LASER, Fiber optics	CO 5, CO 6	T2:16.5; R3:8.10
DISCUSSION OF QUESTION BANK			
1	Quantum Mechanics	CO 1	T1:3.3.1; R3:3.2
2	Introduction to Solids and Semiconductors	CO 2	T2:16.5; R3:8.10
3	Semiconductor devices	CO 3	T2:16.5; R3:8.10
4	Engineered electric and magnetic materials	CO 4	T1:3.3.1; R3:3.2
5	LASER, Fiber optics	CO 5, CO 6	T2:16.5; R3:8.10

Signature of Course Coordinator **HOD, FE**
Dr. N. Shankaraiah, Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUER SCIENCE & ENGINEERING**				
Course Title	**PROBABILITY AND STATISTICS**				
Course Code	AHSC08				
Program	B.Tech				
Semester	II	CSE			
Course Type	Foundation				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Ms. P Naga Lakshmi Devi, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
10+2	-	-	Fundamentals of Statistics

II COURSE OVERVIEW:

Probability theory is the branch of mathematics that deals with modelling uncertainty. Inferential Statistics and regression analysis together with random variate distributions are playing an exceptional role in designing data driven technology which is familiarly known as data centric engineering. They also have wide variety applications in telecommunications and other engineering disciplines. The course covers advanced topics of probability and statistics with applications. The course includes: random variables, probability distributions, hypothesis testing, confidence intervals, and linear regression. There is an emphasis placed on real-world applications to engineering problems.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Probability and Statistics	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
30 %	Understand
60%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

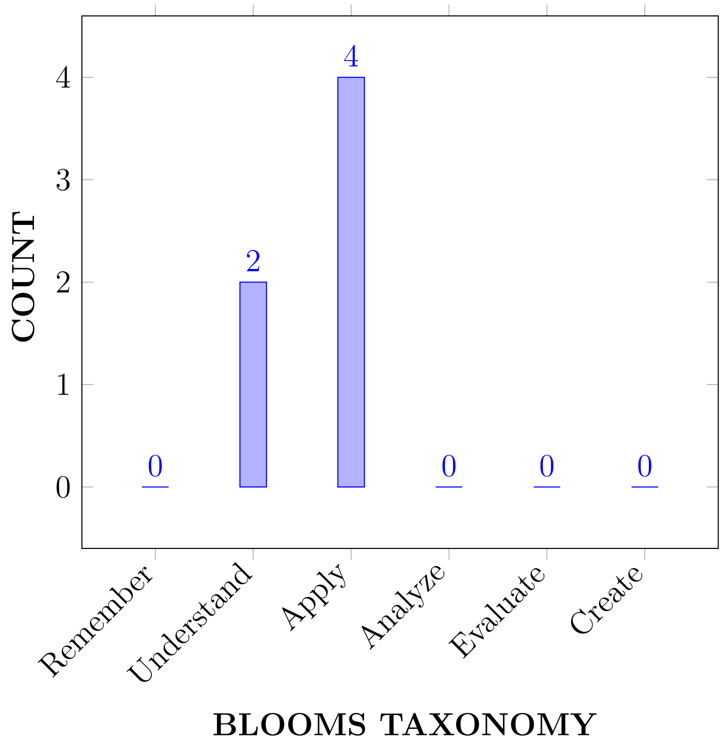
I	The theory of random variables, basic random variate distributions and their applications.
II	The Methods and techniques for quantifying the degree of closeness among two or more variables and the concept of linear regression analysis.
III	The Estimation statistics and Hypothesis testing which play a vital role in the assessment of the quality of the materials, products and ensuring the standards of the engineering process.
IV	The statistical tools which are essential for translating an engineering problem into probability model.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** the role of random variables and types of random variables, expected values of the discrete and continuous random variables under randomized probabilistic conditions.	Understand
CO 2	**Interpret** the parameters of random variate Probability distributions such as Binomial, Poisson and Normal distribution by using their probability functions, expectation and variance.	Understand
CO 3	**Apply** Bivariate Regression as well as Correlation Analysis for statistical forecasting.	Apply
CO 4	**Make Use of** estimation statistics in computing confidence intervals, Regression analysis and hypothesis testing.	Apply
CO 5	**Identify** the role of statistical hypotheses, types of errors, confidence intervals, the tests of hypotheses for large samplein making decisions over statistical claims in hypothesis testing	Apply
CO 6	**Identify** the tests of hypothesis for small sample in making decisions over statistical claims in hypothesis testing	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Program Outcomes	
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	CIE/Quiz/AAT
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Seminar/ Conferences/ Research Papers
PO 5	**Modern Tool Usage:** Use research-based knowledge and research methods including design of eConduct investigations of complex problems:xperiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	Assignments/ Discussion

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	-	-
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	-
CO 5	✓	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-
CO 6	✓	-	-	✓	✓	-	-	-	-	-	-		-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	**PO 1**	Explain (understanding) the concept of random variables and their role in solving complex engineering problems involving random events and uncertainty by using Mathematical functions (principles of mathematics).	2
	PO 4	The expected values, variances for the given discrete random variables will be quantitatively measured by using statistical computer software (R-software).	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 2	**PO 1**	Interpret the Probability distributions such as Binomial, Poisson and Normal distribution (Understanding) with the support of evaluation of integrals (principles of mathematics) and appreciate their importance and applicability (Apply) in solving complex engineering problems involving uncertainty.	2
	PO 2	Understand the statement and formulation of a complex engineering problem which involves the events of uncertainty, Model it with suitable probability distribution and Apply the concepts of discrete or continuous distributions along with basic principles of mathematics to develop the solution and reaching substantiated conclusions by the interpretation of results	5
CO 3	**PO 1**	Interpret (Understand) the results of Bivariate and Correlation Analysis by using ratios, square roots, straight lines and planes (principles of mathematics) for statistical forecasting (Apply)in complex engineering problems involving bivariate or multivariate data.	2
CO 4	**PO 1**	Select appropriate statistical methods (understand) for solving some real-time complex engineering problems governed by correlation with the knowledge of fundamental principles of mathematics.	2
	PO 4	Interpret the results of Bivariate and Multivariate Regression and quantifying the degree of closeness between two or more variables by using statistical computer software (R-software, SPSS-software).	1
CO 5	**PO 1**	Apply tests of hypotheses which involves the role of mathematical tools like statements, sets, ratios and percentages (principles of mathematics) for both large samples and small samples (knowledge) in making decisions over statistical claims that arise in complex engineering problems which requires sampling inspections.	2
	PO 2	Understand the statement and formulation of a complex engineering problem which needs verification of truth values of numerical or statistical hypothesis, collect the necessary information and data through sampling techniques, apply tests of hypotheses (both large and small samples) along with basic principles of mathematics to develop the solution and reaching substantiated conclusions by the interpretation of results	5
	PO 4	Make Use of R software package in computing confidence intervals, statistical averages and hypothesis testing. (Computer software relevance)	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 6	**PO 1**	Identify the role of types of statistical hypotheses, types of errors, sampling distributions of means and confidence intervals with the aid of statements and sets, percentages (principles of mathematics) in hypothesis testing of complex engineering problems which requires sampling inspections.	2
	PO 4	Test for the assessment of goodness of fit of the given probability distribution model by using statistical quantitative methods and statistical computer software (R-software).	1
	PO 5	Make Use of R software package a in modeling complex Engineering activities which involves computation of confidence intervals, statistical averages and regression analysis, hypothesis testing.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	-	-	1	-	-	-	-	-	-	-		-	-	-
CO 5	2	5	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 6	2	-	-	1	1	-	-	-	-	-	-		-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.7	-	-	9.0	-	-	-	-	-	-	-		-	-	-
CO 2	66.7	50.0	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	66.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	66.7	-	-	9.0	-	-	-	-	-	-	-	-	-	-	-
CO 5	66.7	50.0	-	9.0	-	-	-	-	-	-	-	-	-	-	-
CO 6	66.7	-	-	9.0	100	-	-	-	-	-	-		-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -5 $< C \leq 40\%$ – Low/ Slight

2 - 40 % $< C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	-	-	1	3	-	-	-	-	-	-		-	-	-
TOTAL	18	4	-	4	3	-	-	-	-	-	-	-	-	-	-
AVERAGE	3	2	-	1	3	-	-	-	-	-	-	-	-	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	Tech Talk	✓	Concept video	✓
Assignments	-				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**PROBABILITY AND RANDOM VARIABLES**
	Random variables: Basic definitions, discrete and continuous random variables; Probability distribution: Probability mass function and probability density functions; Mathematical expectation.
MODULE II	**PROBABILITY DISTRIBUTION**
	Binomial distribution; Mean and variances of Binomial distribution, Recurrence formula for the Binomial distribution; Poisson distribution: Poisson distribution as a limiting case of Binomial distribution, mean and variance of Poisson distribution, Recurrence formula for the Poisson distribution; Normal distribution; Mean, Variance, Mode, Median, Characteristics of normal distribution.
MODULE III	**CORRELATION AND REGRESSION**
	Correlation: Karl Pearson's Coefficient of correlation, Computation of correlation coefficient, Rank correlation, Repeated Ranks; Properties of correlation. Regression: Lines of regression, Regression coefficient, Properties of Regression coefficient, Angle between two lines of regression.

MODULE IV	**TEST OF HYPOTHESIS – I**
	Sampling: Definitions of population, Sampling, Parameter of statistics, standard error; Test of significance: Null hypothesis, alternate hypothesis, type I and type II errors, critical region, confidence interval, level of significance. One sided test, two-sided test. Large sample test: Test of significance for single mean, Test of significance for difference between two sample means, Tests of significance single proportion and Test of difference between proportions.
MODULE V	**TEST OF HYPOTHESIS – II**
	Small sample tests: Student t-distribution, its properties: Test of significance difference between sample mean and population mean; difference between means of two small samples. Snedecor's F-distribution and its properties; Test of equality of two population variances Chi-square distribution and it's properties; Chi-square test of goodness of fit.

TEXTBOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons Publishers, 9th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2012.

WEB REFERENCES:

1. http://e4uhu.com/down/Applied/9th
2. https://toaz.info/32fa2f50-8490-42cf-9e6a-f50cb7ea9a5b
3. http://www.mathworld.wolfram.com

COURSE WEB PAGE:

https://www.youtube.com/playlist?list=PLzkMouYverAJ1gjLBz4sA5O0ymIi01or6

REFERENCE BOOKS:

1. N. P. Bali, "Engineering Mathematics", Laxmi Publications, 9th Edition, 2016.
2. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand and Co., 10th Edition, 2000.
3. Richard Arnold Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Prentice Hall, 8th Edition, 2013.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	Course outcomes	Reference
OBE DISCUSSION			
1	Identify the types of sampling (random, stratified, systematic, cluster). Identify the misuses of statistics. Student will use appropriate statistical methods to collect, organize, display, and analyze relevant data. Probability & Statistics introduces students to the basic concepts and logic of statistical reasoning and gives the students introductory-level practical ability to choose, generate, and properly interpret appropriate descriptive and inferential methods. Identify the types of data (qualitative, quantitative, discrete, and continuous).		
CONTENT DELIVERY (THEORY)			
2	Probability Basic definitions	CO 1	T2:26.3
3	Probability	CO 1	R2:21.48
4	Axioms of Probability	CO 1	T2:26.6 R2:21.50
5	Conditional Probability	CO 1	T2:26.7 R2:21.51
6	Random Variables	CO 1	T2:26.8
7	Discrete and Continuous random variables	CO 1	T2:26.10
8	Probability distribution	CO 1	T2:26.14 R2:21.55
9	Probability mass function	CO 1	T2:26.15 R2:21.58
10	Probability Density Function	CO 1	T2:26.16 R2:21.61
11	Mathematical Expectation	CO 2	T2:25.12 R2:21.24
12	Binomial Distribution	CO 2	T2:25.16 R2:21.29
13	Mean, Variance and Mode of Binomial Distribution	CO 2	T2:25.14 R2:21.31
14	Expected Frequency of Binomial Distribution	CO 2	T2:25.14 R2:21.33
15	Poisson Distribution	CO 2	R2:21.33
16	Mean, Variance and Mode of Poisson distribution	CO 2	T2:27.2 R2:21.64
17	Expected Frequency of Poisson Distribution	CO 2	T2:27.2
18	Normal distribution – I	CO 2	T2:27.2 R2:21.67

19	Mean and Variance of Normal Distribution	CO 2	T2:27.2
20	Mode and Median of Normal distribution	CO 2	T2:27.3 R2:21.71
21	Normal distribution – II	CO 2	T2:27.4 R2:21.68
22	Correlation	CO 3	T2:27.7 R2:21.74
23	Rank Correlation	CO 3	T2:27.12 R2:21.75
24	Rank Correlation for Repeated Ranks	CO 3	T2:27.8 R2:21.72
25	Regression Lines-I	CO 4	T2:27.8 R2:21.73
26	Regression Lines-II	CO 4	T2:27.14 R2:21.78
27	Regression Lines-III	CO 4	T2:27.19 R2:21.814
28	Sampling distribution – I	CO 5	T2:27.12 R2:21.82
29	Sampling distribution – II	CO 5	T2:27.18 R2:21.82
30	Testing of hypothesis for Large Samples	CO 5	T2:26.15 R2:21.58
31	Test of hypothesis for single mean	CO 5	T2:26.16 R2:21.61
32	Test of hypothesis for difference of means	CO 5	T2:25.14 R2:21.33
33	Test of hypothesis for single proportion	CO 5	R2:21.33
34	Test of hypothesis for difference of proportions	CO 5	T2:27.2 R2:21.64
35	Testing of hypothesis for small samples	CO 6	T2:27.2
36	Student's t-distribution for single mean	CO 6	T2:26.16 R2:21.61
37	Student's t-distribution for difference of means	CO 6	T2:25.12 R2:21.24
38	F-distribution	CO 6	T2:25.16 R2:21.29
39	Chi-Square distribution – I	CO 6	T2:27.14 R2:21.78
40	Chi-Square distribution – II	CO 6	T2:27.19 R2:21.814
41	Chi-Square distribution – III	CO 6	T2:27.12 R2:21.82
PROBLEM SOLVING/ CASE STUDIES			
42	Problems on Probability	CO 1	T2:26.3
43	Problems on Discrete and Continuous random variables	CO 1	R2:21.48

44	Problems on Probability mass function	CO 1	T2:26.6 R2:21.50
45	Problems on Probability density function	CO 1	T2:26.7 R2:21.51
46	Problems on Binomial Distribution	CO 2	T2:26.8
47	Problems on Poisson Distribution	CO 2	T2:26.10
48	Problems on Normal Distribution	CO 2	T2:26.14 R2:21.55
49	Problems on Correlation	CO 3	T2:26.15 R2:21.58
50	Problems on Regression	CO 4	T2:26.16 R2:21.61
51	Problems on Sampling distribution	CO 5	T2:25.12 R2:21.24
52	Problems on Test of hypothesis for single mean and difference of means	CO 5	T2:25.16 R2:21.29
53	Problems on Test of hypothesis for single proportion and difference of proportions	CO 6	T2:25.14 R2:21.31
54	Problems on t-distribution	CO 6	T2:25.14 R2:21.33
55	Problems on F-distribution	CO 6	R2:21.33
56	Problems on Chi-Square distribution	CO 6	T2:27.2 R2:21.64
DISCUSSION OF DEFINITION AND TERMINOLOGY			
57	Definitions terminology discussion on probability and random variables	CO 1	T2:26.6 R2:21.50
58	Probability and Random variables	CO 2	T2:26.7 R2:21.51
59	Definitions& terminology discussion on correlation and regression.	CO 3, CO 4	T2:25.14 R2:21.33
60	Definitions & terminology discussion on Tests of Hypothesis.	CO 5	R2:21.33
61	Definitions & terminology discussion on Tests of significance.	CO 6	R2:21.33

DISCUSSION OF QUESTION BANK			
62	Question bank discussion on Probability, Random variables and Probability Distributions	CO 1	T2:26.6 R2:21.50
63	Question bank discussion on probability distributions.	CO 2	T2:26.7 R2:21.51
64	Question bank discussion on correlation and regression.	CO 3,CO 4	T2:25.14 R2:21.33
65	Question bank discussion on Tests of Hypothesis.	CO 5	R2:21.33
66	Question bank discussion on Tests of significance.	CO 6	R2:21.33

Course Coordinator: **HOD CSE**
Ms. P Naga Lakshmi Devi

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	PROGRAMMING FOR PROBLEM SOLVING USING C				
Course Code	ACSC04				
Program	B.Tech				
Semester	II				
Course Type	FOUNDATION				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr. J Sirisha Devi, Associate Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	-	-	Basic Programming Concepts

II COURSE OVERVIEW:

The course emphasis on the problem-solving aspects in using C programming. It is the fundamental course and is interdisciplinary in nature for all engineering applications. The students will understand programming language, programming, concepts of loops, reading a set of data, step wise refinements, functions, control structures, arrays, dynamic memory allocations, enumerated data types, structures, unions, and file handling. This course provides adequate knowledge to solve problems in their respective domains.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
PPSC	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
20%	Remember
30%	Understand
50%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

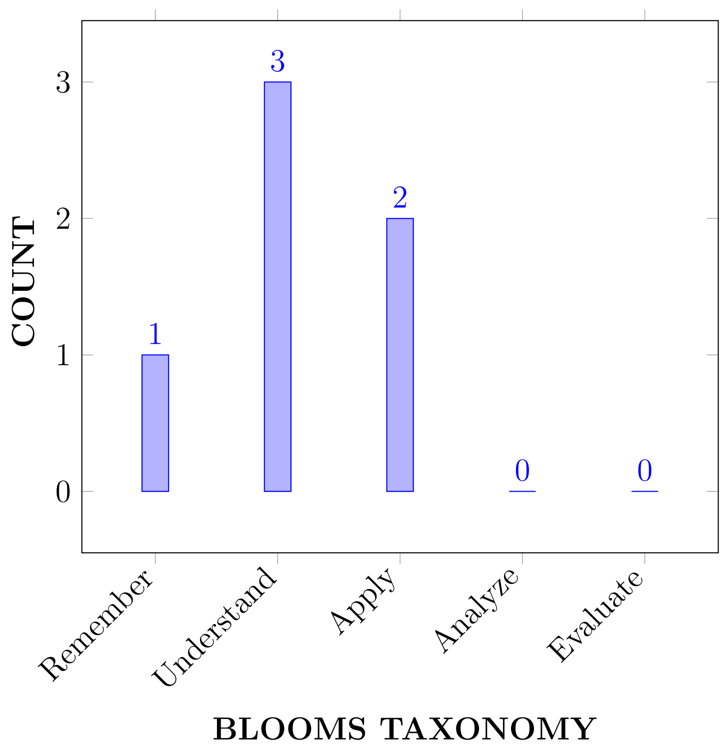
I	Problem-solving through programming.
II	Programming language, programming, reading a set of Data, stepwise refinement, concepts of Loops, Functions, Control structure, Arrays, Structure, Pointer and File concept.
III	To build efficient programs in C language essential for future programming and software engineering courses.
IV	Acquire programming skills in C Programming.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Define** the algorithms and draw flowcharts for solving Mathematical and Engineering problems.	Remember
CO 2	**Construct** programs for decision structures and loops.	Apply
CO 3	**Interpret** various types of functions, arrays, and strings for complex problem solving.	Understand
CO 4	**Illustrate** he dynamic memory allocation, structures, unions and enumerations to solve problems.	Understand
CO 5	**Interpret** file input and output functions to do integrated programming.	Understand
CO 6	**Utilize** the algorithms in C language to real-life computational problems.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE/SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	2	Open Ended Experiments

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to problem solving through programming.	2	Tech talk/Open ended experiments
PSO 2	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	Tech talk/Open ended experiments

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 2	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-
CO 4	✓	✓	-	-	✓	-	-	-	-	-	-		-	-	-
CO 5	✓	-	-	-	✓	-	-	-	-	-	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	-	-	✓	-	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Developing algorithms and draw flowcharts for solving **mathematical** and **engineering problems** related to **areas of computer science.**	3
	PO 2	Understand the various symbols to **draw** a flowchart, **identify** the appropriate symbols to solve a problem, then **formulate** the solution, and **interpret** the result for the **improvement** of the **solution.**	6
	PSO 1	Understand the features of procedural programming for **designing** and **analyzing** computer programs for **problem-solving.**	3
CO 2	PO 1	Understand branching statements, loop statements, and apply the fundamentals of **mathematics**, **science** and **engineering**.	3
	PO 2	Understand the **problem statement**, **control** the flow of data, **design** the solution and **analyze** the same to **validate** the results in a program to solve **complex** engineering problems.	6
	PO 3	**Recognize** an appropriate control structure to **design** and **develop** a solution for a **real-time** scenario, and **communicating** effectively with engineering community.	5
CO 3	PO 1	Recognize the importance of recursionfor developing programs in real-time scenarios using principles of **mathematics**, and **engineering fundamentals**.	3
	PO 2	Understand the various kinds of **functions**, **identify** the suitable type of function to **solve** a problem, **formulate** the solution, and **interpret** the result for the **improvement** of the solution.	6
	PO 5	Apply techniques of **structured decomposition** to dividea problem into smaller pieces with an understanding of its limitations.	1
CO 4	PO 1	Extend the focus on the usage of heterogeneous data types as a **basic building block** in problem solving using principles of **science**, and **engineering** fundamentals.	3
	PO 2	**Recognize** the representation of the structure, **assess** in solving a problem, **express the solution**, and **analyze** the result for **solution enhancement**.	5

	PO 5	Understand pointers conceptually and apply them in modeling a **complex engineering** activity.	1
CO 5	PO 1	Make a use of an appropriate type of file to store a large volume of **persistent data** and give solution to **engineering problems**.	2
	PO 5	To identify appropriate mode to access a file and run the same **program** multiple times.	1
CO 6	PO 12	**Realize** the need and the desire to **train** and **invest** in autonomous and **lifelong learning** in the widest sense of **technical transition** to achieve **employability expertise** and excel advanced **engineering concepts**.	7
	PSO 3	Attain the **knowledge** and **skills** for employability and to succeed in national and international level **competitive examinations**.	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	6	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 2	3	6	5	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	6	-	-	1	-	-	-	-	-	-	-	-		-
CO 4	3	5	-	-	1	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	-	-	7	-	-	3

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	60	-	-	-	-	-	-	-	-	-	-	50	-	-
CO 2	100	60	50	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	100	60	-	-	100	-	-	-	-	-	-	-	-	-	-
CO 4	100	50	-	-	100	-	-	-	-	-	-	-	-	-	-
CO 5	66	-	-	-	100	-	-	-	-	-	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	-	-	58	-	-	50

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -5 $< C \leq 40\%$ – Low/ Slight
2 - 40 % $< C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	-	-	3	-	-	-	-	-	-	-	-		-
CO 4	3	2	-	-	3	-	-	-	-	-	-	-	-	-	-
CO 5	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2
TOTAL	15	11	2	-	9	-	-	-	-	-	-	2	2	-	2
AVERAGE	3	2.7	2.5	-	3	-	-	-	-	-	-	2	2	-	2

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	-				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

-	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION**
	Introduction to components of a computer: Memory, processor, I/O Devices, storage, operating system; Concept of assembler, compiler, interpreter, loader and linker. **Idea of Algorithms:** Algorithms, Flowcharts, Pseudo code with examples, From algorithms to Programs. **Introduction to C Programming Language:** History of C, Basic structure of a C program, Process of compiling and running a C program; C Tokens: Keywords, Identifiers, Constants, Strings, Special symbols, Variables, Data types; Operators, Precedence of Operators, Expression evaluation, Formatted Input/Output functions, Type Conversion and type casting.
MODULE II	**CONTROL STRUCTRES**
	Decision Making Statements: Simple if, if-else, else if ladder, Nested if, switch case statement; **Loop control statements:** for, while and do while loops, nested loops; **Unconditional Control Structures:** break, continue and goto statements.

MODULE III	**ARRAYS AND FUNCTIONS**
	Arrays: Introduction, Single dimensional array and multi-dimensional array: declaration, initialization, accessing elements of an array; Operations on arrays: traversal, reverse, insertion, deletion, merge, search; **Strings:** Arrays of characters, Reading and writing strings, String handling functions, Operations on strings; array of strings. **Functions:** Concept of user defined functions, Function declaration, return statement, Function prototype, Types of functions, Inter function communication, Function calls, Parameter passing mechanisms; Recursion; Passing arrays to functions, passing strings to functions; Storage classes.
MODULE IV	**POINTERS AND STRUCTURES**
	Pointer: Basics of pointers, Pointer arithmetic, pointer to pointers, array of pointers, Generic pointers, Null pointers, Pointers as functions arguments, Functions returning pointers; Dynamic memory allocation. **Structures:** Structure definition, initialization, structure members, nested structures, arrays of structures, structures and functions, structures and pointers, self-referential structures; Unions: Union definition, initialization, accessing union members; bit fields, typedef, enumerations, Preprocessor directives.
MODULE V	**FILE HANDLING AND APPLICATIONS IN C**
	File Handling: Concept of a file, text files and binary files, streams, standard I/O, formatted I/O, file I/O operations, error handling, Line I/O, miscellaneous functions; Applications in C.

TEXTBOOKS

1. Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rd Edition, 2017

2. Reema Thareja, "Programming in C", Oxford university press, 2nd Edition, 2016.

REFERENCE BOOKS:

1. W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd Edition, 1988.

2. Yashavant Kanetkar, "Exploring C", BPB Publishers, 2nd Edition, 2003.

3. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.

4. R. S. Bichkar, "Programming with C", Universities Press, 2 nd Edition, 2012.

5. Dey Pradeep, Manas Ghosh, "Computer Fundamentals and Programming in C", Oxford University Press, 2nd Edition, 2006.

6. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

WEB REFERENCES:

1. https://www.nptel.ac.in/courses/108106073/

2. https://www.iare.ac.in

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Discussion on Outcome Based Education, CO, PO and CO-PO Mapping		
CONTENT DELIVERY (THEORY)			
2	Understand components of a computer	CO 1	T2: 1.1-1.2, R4: 1.1-1.3
3	Identify and apply algorithms and flowcharts for problem solving	CO 1	T2: 2.1-2.2, R4: 1.4
4	Understand pseudo code for a given problem	CO 1	T2: 2.1-2.2
5	Understand the basic structure, process of compiling and running a C program	CO 1	T2: 2.1-2.2,
6	Understand keywords, identifiers, constants, strings, special symbols, variables	CO 1	T2: 1.4 -1.5, R4: 2.1 - 2.4
7	Define the data types, and operators to write C Program	CO 1	T2: 2.1-2.2
8	Understand precedence of operators, expression evaluation	CO 1	T2: 2.3-2.6
9	Understand formatted input/output functions, Type Conversion and type casting in C Programming	CO 1	T2: 2.3-2.7
10	Identify and apply decision making statements in C programming	CO 2	T2: 3.1-3.5
11	Identify and apply loop control structures in C programming	CO 2	T2: 5.2-5.3
12	Identify and apply unconditional control structures in C programming	CO 2	T2: 6.1-6.6
13	Understand single dimensional array and multi-deimensional array: declaration, initialization, accessing	CO 3	T2: 6.7
14	Operations on arrays: traversal, reverse, insertion	CO 3	T2: 8.1-8.2, R4: 15.1
15	Operations on arrays: deletion, merge, search	CO 3	T2: 8.3, R4: 15.1
16	Arrays of characters, Reading and writing strings, String handling functions	CO 3	T2: 11.1-11.5
17	Operations on strings: array of strings	CO 3	T2: 4.1-4.5
18	Concept of user defined functions, Function declaration	CO 3	T1: 7
19	return statement, Function prototype	CO 3	T2: 6.9

20	Types of functions, Inter function communication	CO 3	T1: 10, T2:10.1-10.2
21	Function calls, Parameter passing mechanisms, Recursion	CO 3	T2: 10.3-10.4, R4:8.3-8.4
22	Passing arrays to functions, passing strings to functions	CO 3	T2:10.5
23	Storage classes	CO 3	T1: 8.9, R4:8.6.3
24	Basics of pointers, Pointer arithmetic	CO 4	T2: 3.1, R4:11.1
25	Pointer to pointers	CO 4	T2: 3.2
26	Array of pointers	CO 4	T2: 3.2
27	Generic pointer, Null pointers	CO 4	T2: 3.3
28	Pointers as function arguments, Functions returning pointers	CO 4	T2: 3.4-3.5
29	Dynamic memory allocation	CO 4	T2: 6.1-6.6
30	Structure definition, initialization, structure members	CO 4	T2: 12.3-12.4, R4:13.4
31	Nested structures	CO 4	T2: 12.3-12.4, R4:13.4
32	Arrays of structures, structures and functions	CO 4	T2: 2.1-2.2, R4:13.2
33	Structures and pointers, self-referential structures	CO 4	T2: 2.1-2.2
34	Union, bit fields, typedef	CO 4	T2: 12.4
35	Enumerations, Preprocessor directives	CO 4	T1: 8.9, T2: 2.3-2.5
36	Concept of a file, text files and binary files, streams	CO 5	T2: 10.4, R4:14.1-14.4
37	Standard I/O, formatted I/O, file I/O operations	CO 5	T2: 10.4, R4:14.1-14.4
38	Error handling	CO 5	R3: 12.1 - 12.3
39	Line I/O, miscellaneous functions	CO 5	R3: 12.1 - 12.3
40	Applications of C	CO 6	R4: 17
PROBLEM SOLVING/ CASE STUDIES			
1	Write a program in C that takes minutes as input, and display the total number of hours and minutes.	CO 1	T2:2.3-2.6

2	Write a program in C that reads a forename, surname and year of birth and display the names and the year one after another sequentially.	CO 1	T2:2.3-2.7
3	Write a C program to find the third angle of a triangle if two angles are given.	CO 2	T2:3.1-3.5
4	Write a program in C to display the such a pattern for n number of rows using a number which will start with the number 1 and the first and a last number of each row will be 1.	CO 2	T2:5.2-5.3
5	Write a program in C to find the prime numbers within a range of numbers.	CO 2	T2:5.2-5.3
6	Write a program in C to display the n terms of harmonic series and their sum.	CO 2	T2:6.1-6.6
7	Write a program in C to display the pattern like right angle triangle using an asterisk.	CO 2	T2:5.2-5.3
8	Program to accept N integer number and store them in an array AR. The odd elements in the AR are copied into OAR and other elements are copied into EAR. Display the contents of OAR and EAR	CO 3	T2: 6.7
9	Write a C program to illustrate how user authentication is made before allowing the user to access the secured resources. It asks for the user name and then the password. The password that you enter will not be displayed, instead that character is replaced by '*'	CO 3	T2: 8.3, R4:15.1
10	Write a C program to accept a matric and determine whether it is a sparse matrix. A sparse martix is matrix which has more zero elements than nonzero elements	CO 3	T2: 8.1-8.2, R4: 15.1
11	Write a C program to accept a amtric of order MxN and sort all rows of the matrix in ascending order and all columns in descendng order	CO 3	T2: 6.7
12	Write a C program to accept a set of names and sort them in an alphabetical order, Use structures to store the names	CO 4	T2:12.3-12.4, R4:13.4
13	Write a C program to find the sum of two one-dimensional arrays using Dynamic Memory Allocation	CO 4	T2:6.1-6.6
14	Write a program in C to find the content of the file and number of lines in a Text File.	CO 5	T2:10.4, R4:14.1-14.4
15	Write a program in C to replace a specific line with another text in a file.	CO 5	T2:10.4, R4:14.1-14.4
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Module I- Components of computers, C programming language	CO 1	T2:1.1-2.6, R4:1.1-2.4
2	Module II- Control structures	CO 2	T2:3.1-6.6

3	Module III- Arrays, Strings and Functions	CO 3	T1:7, T2:6.7-11.5
4	Module IV- Pointers and Structures	CO 4	T2:3.1-6.6, R4:11.1-13.4
5	Module V- File handling functions	CO 5	T2:10.4, R4:14.1-14.4, R3:12.1-12.3
DISCUSSION OF QUESTION BANK			
1	Module I- Components of computers, C programming language	CO 1	T2:1.1-2.6, R4:1.1-2.4
2	Module II- Control structures	CO 2	T2:3.1-6.6
3	Module III- Arrays, Strings and Functions	CO 3	T1:7, T2:6.7-11.5
4	Module IV- Pointers and Structures	CO 4	T2:3.1-6.6, R4:11.1-13.4
5	Module V- File handling functions	CO 5	T2:10.4, R4:14.1-14.4, R3:12.1-12.3

Signature of Course Coordinator **HOD,CSE**
Dr. J Sirisha Devi, Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043
COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Course Title	**English Language and Communication Skills Laboratory**				
Course Code	AHSC04				
Program	B.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE - UG 20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	0	0	0	3	1.5
Course Coordinator	Mr. P. Sunil Solomon, Assistant Professor of English				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
10+2		I	Basic principles of communication skills and concepts of functional English grammar.

II COURSE OVERVIEW:
This lab course is designed to introduce the students to create wide exposure on language learning techniques regarding the basic elements of Listening, Speaking, Reading and Writing. In this lab the students are trained in communicative English language skills, phonetics, word accent, word stress, rhythm intonation, oral presentations and extempore The students are also taught in terms of seminars, group-discussions, presenting techniques of writing, participating in role plays, telephonic etiquettes, asking and giving directions, information transfer , debates, description of persons, places and objects etc; . The lab encourages the students to work in a group, engage in peer-reviews and inculcate team spirit through various exercises on grammar, vocabulary, and pronunciation games etc. Students will make use of all these language skills in academic, professional and real time situations.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
English Language and Communication Skills Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

X	Demo Video	X	Lab Worksheets	X	Viva Questions	X	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	-
20 %	Analysis	-
20 %	Design	-
20 %	Conclusion	-
20 %	Viva	-

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

VI COURSE OBJECTIVES:

The students will try to learn:

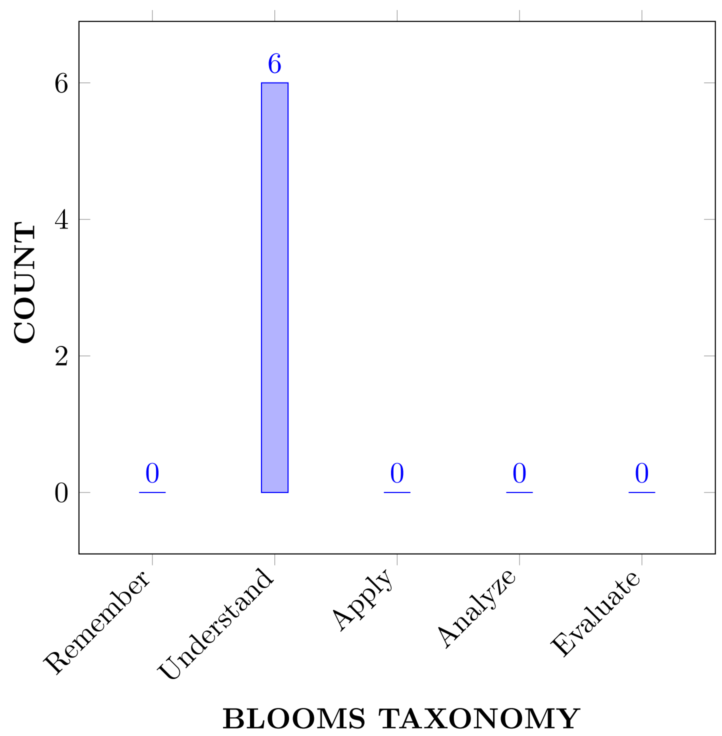
I	Facilitate computer-assisted multi-media instructions to make possible individualized and independent language learning.
II	The critical aspect of speaking and reading for interpreting in-depth meaning of the sentences.
III	Use language appropriately for social interactions such as public speaking, group discussions and interviews.
IV	Habituate using English speech sounds, word accent, intonation and rhythm.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Discuss** the prime necessities of listening skill for improving pronunciation in academic and non-academic purposes.	Understand
CO 2	**Summarize** the knowledge of English phonetics for speaking accepted language and describe the procedure of phonemic transcriptions and intonation patterns.	Understand
CO 3	**Express** about necessity of stressed and unstressed syllables in a word with appropriate length and clarity.	Understand
CO 4	**Explain** how writing skill fulfills the academic and non-academic requirements of various written communicative functions	Understand
CO 5	**Generalize** appropriate concepts and methods from a variety of disciplines to solve problems effectively and creatively	Understand
CO 6	**Classify** the roles of collaboration, risk-taking, multi-disciplinary awareness, and the imagination in achieving creative responses to problems	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 9	**Engineering knowledge:** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	3	CIE / SEE/ Lab Exercises

PO 10	**Communicate:** effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (Communication)	5	CIE / SEE/ Lab Exercises

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	ENGINEERING KNOWLEDGE: Build the prototype of UAVs and aero-foil models for testing by using low speed wind tunnel towards research in the area of experimental aerodynamics.		
PSO 2	BROADNESS AND DIVERSITY: Focus on formulation and evaluation of aircraft elastic bodies for characterization of aero elastic phenomena.		
PSO 3	SELF LEARNING AND SERVICE: Make use of multi physics, computational fluid dynamics and flight simulation tools for building career paths towards innovative startups, employability and higher studies.		

3 = High; 2 = Medium; 1 = Low

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Courses Outcomes	Program Outcomes		Program Specific Outcomes		
	PO 9	PO 10	PSO 1	PSO 2	PSO 3
CO 1	-	5	-	-	
CO 2	3	-	-	-	
CO 3	-	5	-	-	
CO 4	-	5	-	-	
CO 5	-	5	-	-	
CO 6	-	5	-		

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**INTRODUCTION ABOUT ELCS LAB..**
	Introducing Self and Introducing Others – feedback.
WEEK II	**INTRODUCTION TO PHONETICS AND PRACTICING CONSONANTS**
	Describing a person or place or a thing using relevant adjectives – feedback.
WEEK III	**PRACTICING VOWEL SOUNDS.**
	JAM Sessions using public address system.
WEEK IV	**STRUCTURE OF SYLLABLES.**
	Giving directions with the help of using appropriate phrases – activities.
WEEK V	**WORD ACCENT AND STRESS SHIFTS. – PRACTICE EXERCISES.**
	Starting a conversation, developing and closing appropriately using fixed expressions..
WEEK VI	**PAST TENSE AND PLURAL MARKERS.**
	Role Play activities.
WEEK VII	**WEAK FORMS AND STRONG FORMS.**
	Oral Presentation..
WEEK VIII	**INTRODUCTION TO INTONATION- USES OF INTONATION - TYPES OF INTONATION- PRACTICE EXERCISES.**
	Expressions In various situations.
WEEK IX	**NEUTRALIZATION OF MOTHER TONGUE INFLUENCE (MTI).**
	Sharing Summaries or Reviews on the topics of students' choice.
WEEK X	**COMMON ERRORS IN PRONUNCIATION AND PRONUNCIATION PRACTICE THROUGH TONGUE TWISTERS.**
	Interpretation of Proverbs and Idioms.
WEEK XI	**LISENING COMPREHENSION.**
	Etiquettes.
WEEK XII	**TECHNIQUES AND METHODS TO WRITE SUMMARIES AND REVIEWS OF VIDEOS.**
	Writing Messages, Leaflets And Notices Etc.
WEEK XIII	**COMMON ERRORS.**
	Resume Writing.
WEEK XIV	**INTRODUCTION TO WORD DICTIONARY.**
	Group Discussions – Video Recording – Feedback.
WEEK XV	**INTRODUCTION TO CONVERSATION SKILLS.**
	Mock Interviews.

TEXTBOOKS

1. ENGLISH LANGUAGE AND COMMUNICATION SKILLS: LAB MANUAL

REFERENCE BOOKS:

1. . Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles and Practices", Oxford University Press, New Delhi, 3rd Edition, 2015.

2. Rhirdion, Daniel, "Technical Communication", Cengage Learning, New Delhi, 1st Edition, 2009.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Introduction about ELCS Lab, Introducing Self and Introducing others – Feedback.	CO 2	R1: 1.2
2	Introduction to Phonetics and Practicing Consonants, Describing a Person or Place or a thing using relevant Adjectives – Feedback.	CO 2	R2: 25-30
3	Practicing Vowel Sounds,Jam Sessions using Public Address System.	CO 2	R1: 28-29,49-54
4	Structure of Syllables, Giving Directions with the help of using appropriate Phrases – Activities.	CO 3	R1: 23-38
5	Word accent and Stress shifts. – Practice Exercises, Starting a Conversation, Developing and Closing appropriately using Fixed Expressions.	CO 3	R1: 2.4
6	Past Tense And Plural Markers,	CO 2	R3: 4.5
7	Weak Forms and Strong Forms,Oral Presentation.	CO 2	R3: 4.6
8	Introduction to Intonation- Uses of Intonation - Types of Intonation- Practice Exercises, Expresions in various situations.	CO 2	R2: 39-42
9	Neutralization Of Mother Tongue Influence (Mti), Sharing Summaries or Reviews on the Topics Of Students' Choice.	CO 2	R2: 5.2
10	Common Errors in Pronunciation and Pronunciation Practice through Tongue Twisters, Interpretation of Proverbs and Idioms.	CO 2	R1:42-43
11	Lisening Comprehension, Etiquettes	CO 5	R1:44-48
12	Techniques and Methods to Write Summaries and Reviews of Videos,Writing Messages, Leaflets and Notices Etc.	CO 4	R1:107-110
13	Common Errors, Resume Writing.	CO 4	R1:7.3
14	Introduction to Word Dictionary,Group Discussions – Video Recording – Feedback.	CO 5	R1:7.3
15	Introduction to Conversation Skills,Mock Interviews.	CO 6	R1: 54-58

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	**Effective listening skills can be used in professional and personal platforms in future.**
2	**By learning LSRW skills, students can enhance desired language skills to fulfill their needs.**

3	**Practicing presentation skills will boost confidence at work place.**
4	**The overall experiments of the laboratory will lead to be an effective communicator.**
5	**The Students will develop critical comprehensive skills to solve the career related problems in future.**

Signature of Course Coordinator **HOD**
Mr. P. Sunil Solomon, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Course Title	**PHYSICS LABORATORY**				
Course Code	AHSC05				
Program	B.Tech				
Semester	II	CSE			
Course Type	FOUNDATION				
Regulation	IARE - UG 20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Mr. K Saibaba, Assistant Professor				

I COURSE OVERVIEW:

This lab course provides hands on experience in a number of experimental techniques and developscompetenceintheinstrumentationtypicallyusedinphysics.This also develops student's expertise in applying physical concepts to practical problem and in learning about experimental techniques with advanced equipments. This laboratory includes experiments involving electromagnetism and optoelectronics.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Basic principles of physics	1.5

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Physics laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing Further Experiments

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day-to-day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the principal from the panel of experts recommended by Chairman, BOS.
The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component	**Laboratory**		Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

A. Experiment Based

Objective	**Analysis**	**Design**	**Conclusion**	**Viva**	**Total**
2	2	2	2	2	10

B. Programming Based

Purpose	**Algorithm**	**Program**	**Conclusion**	**Viva**	**Total**
-	-	-	-	-	-

VI COURSE OBJECTIVES:

The students will try to learn:

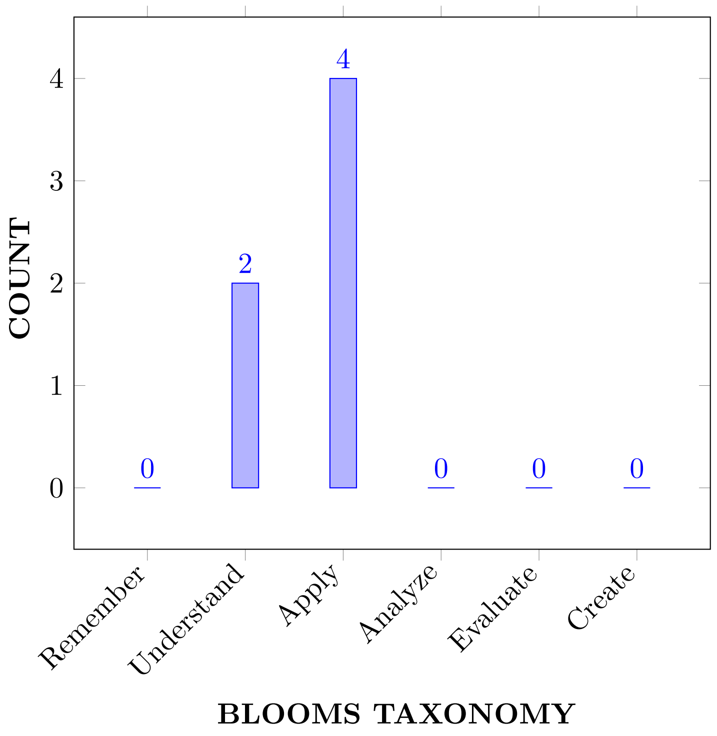
I	To familiarize with the lab facilities, equipment, standard operating procedures.
II	About the different kinds of functional electric and magnetic materials which paves a way for them to use in various technical and engineering applications.
III	The analytical techniques and graphical analysis to study the experimental data for optoelectronic devices.
IV	The applications of variation in the intensity of light due to natural phenomena like interference and diffraction.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** the type of semiconductor using the principle of Hall Effect and also determine the energy gap of a semiconductor diode.	Apply
CO 2	**Illustrate** principle, working and application of wave propagation and compare results with theoretical harmonics and overtones.	Understand
CO 3	**Investigate** the energy losses associated with a given Ferro magnetic material and also magnetic field induction produced at various points along the axis of current carrying coil.	Apply
CO 4	**Examine** launching of light through optical fiber from the concept of light gathering capacity of numerical aperture.	Understand
CO 5	**Utilize** ththe phenomena of interference and diffraction for the determination of various parameters like radius of curvature of convex lens, wavelength of laser light and width of single slit.	Apply
CO 6	**Investigate** V-I/L-I characteristics of various optoelectronic devices like Light Emitting Diode, Photodiode to understand their basic principle of functioning as well as to infer the value of Planck's constant.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Laboratory experiments, internal and external lab examinations.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Laboratory experiments, internal and external lab examinations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Laboratory experiments, internal and external lab examinations.

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	1	Laboratory experiments and Surveys

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	**Justification for mapping (Students will be able to)**	No. of Key Competencies
CO 1	PO 1	Identify basic principle of Hall effect and make use of mathematical expression for Hall coefficient to deduce the type of semiconductor.	2
	PO 2	Understand the given problem statement of identification of type of semiconductor and formulate Hall coefficient from experimental collection of information and data in reaching substantial conclusions by the interpretation of results.	4
	PO 1	Determine the energy gap of a semiconductor diode by making use of graphical analysis of current versus temperature curve.	2

CO 2	PO 1	Recall the theory of propagation of longitudinal and transverse waves and make use of number of loops formation in string to determine frequency of an electronically maintained tuning fork.	2
	PO 2	Understand the given problem statement of stationary wave propagation and formulate harmonics and overtones of fundamental frequency from experimental collection of information and data in reaching substantial conclusions by the interpretation of results.	4
CO 3	PO 1	Explain the variation of magnetic field at various points along the axis of current carrying coil and make use of mathematical expression of Tangent's law using Stewart Gee's apparatus.	2
	PO 2	Understand the given problem statement of current loop and formulate magnetic field induction at various points along the axis of current loop from experimental collection of information and data in reaching substantial conclusions by the interpretation of results.	4
	PO 1	Investigate the energy losses associated with a given ferromagnetic material and make use of graphical representation of hysteresis loop exhibited by magnetic material.	2
	PO 2	Understand the given problem statement of energy losses associated with a given ferromagnetic material and formulate hysteresis loop from experimental collection of information and data in reaching substantial conclusions by the interpretation of results.	4
	PO 4	Apply simulation tool to get hysteresis curve of a ferromagnetic material and understand energy losses associated with material.	1
	PSO 3	Make use of modern simulation tool to get information about energy losses associated with a ferromagnetic material.	1
CO 4	PO 1	Interpret launching of light through optical fiber and make use of mathematical expression for analyzing light gathering capacity through numerical aperture.	2
	PO 4	Make use of optical fiber trainer kit and understand conversion of electrical to light energy..	1
CO 5	PO 1	Explain the concept of interference in Newton's rings and make use of it to determine the radius of curvature of convex lens.	2
	PO 4	Make use of microscope to get Newton's rings and understand the phenomenon of interference in reflected light.	1
	PO 1	Recollect the phenomena of diffraction from N-slits and make use of it for the determination of wavelength of a given laser.	1

	PO 1	Understand the phenomenon of single slit diffraction and make use of it to determine the slit width by using laser light as monochromatic source.	1
CO 6	PO 1	Explain the V-I characteristics of light emitting diode and infer the value of planck's constant by plotting temperature versus current curve.	2
	PO 1	Understand the phenomenon of recombination of electron-hole pair and determine the value of threshold voltage of a given LED.	2
	PO 1	Illustrate the variation of photo current with light intensity in a photo diode.	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES			PSO'S
	PO 1	PO 2	PO 4	PSO 3
CO 1	3	2	-	-
CO 2	3	2	1	-
CO 3	3	-	-	1
CO 4	3	2	1	-
CO 5	3	-	1	-
CO 6	3	2	1	-

3 = High; 2 = Medium; 1 = Low

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK 1	**HAL LEFFECT (LORENTZFORCE)**
	Determination of charge carrier density.
WEEK 2	**MELDE'S EXPERIMENT**
	Determination of frequency of a given tuning fork
WEEK 3	**STEWART GEE'S APPARATUS**
	Magnetic field along the axis of current carrying coil – Stewart and Gee's method.
WEEK 4	**B-H CURVE WITH CRO**
	To determine the value of retentivity and coercivity of a given magnetic material.
WEEK 5	**ENERGY GAP OF A SEMICONDUCTOR DIODE**
	Determination of energy gap of a semiconductor diode.
WEEK 6	**PHOTO DIODE**
	Studying V-I characteristics of Photo Diode.
WEEK 7	**OPTICAL FIBER**
	Evaluation of numerical aperture of a given optical fiber.
WEEK 8	**WAVELENGTH OF LASER LIGHT**
	Determination of wavelength of a given laser light using diffraction grating.
WEEK 9	**PLANK'S CONSTANT**
	Determination of Plank's constant using LED.
WEEK 10	**LIGHT EMITTING DIODE**
	Studying V-I Characteristics of LED.
WEEK 11	**NEWTONS RINGS**
	Determination of radius of curvature of a given plano - convex lens.
WEEK 12	**SINGLE SLIT DIFFRACTION**
	Determination of width of a given single slit.

TEXTBOOKS

1. 1 CL Arora, "Practical Physics", S Chand and Co.,New Delhi, 3rd Edition,2012.

2. 2 Vijay Kumar, Dr. T. Radha krishna, "Practical Physics for Engineering Students", S M Enterprises, 2nd Edition, 2014.

REFERENCE BOOKS:

1. 1 CF Coombs,"Basic Electronic Instrument Handbook", McGraw - HillBookCo.,1972.

2. 2 CH Bernardand CD Epp, John Wiley and Sons, " Laboratory Experiments in College Physics" Inc.,NewYork,1995.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Determination of charge carrier density.	CO 1	T1:13.5
2	Determination of frequency of a given tuning fork.	CO 2	T1:13.5
3	Determination of Magnetic field along the axis of current carrying coil – Stewart and Gee's method.	CO 3, CO 4	TT1:14.7
4	Determination of the energy loss per unit volume of a given magnetic material per cycle by tracing the Hysteresis loop.	CO 3	T1:15.7
5	Determination of energy gap of a semiconductor diode.	CO 1	T1:16.8
6	Studying V-I Characteristics of Photo Diode.	CO 6	T1:16.9
7	Evaluation of numerical aperture of a given optical fiber.	CO 4	T1:17.9
8	Determination of wavelength of a given laser light using diffraction grating.	CO 5	T1:18.10
9	Determination of Plank's constant using LED.	CO 6	T1:19.10
10	Studying V-I characteristics of LED	CO 6	T1:19.9
11	Determination of radius of curvature of a given Plano-convex lens.	CO 5	T1:23.10
12	Determination of width of a given single slit.	CO 5	T1:23.10

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	To determine the wavelength of different colored light using white light source by Newton's ring method
2	To study the bending losses and transmission losses of an optical Fiber
3	To observe the dispersion of prism by using spectrometer.
4	Study the characteristics of Laser diode.
5	To illustrate the interference pattern produced from the air wedge.
6	To determine the voltage current characteristics of solar cell

Signature of Course Coordinator **HOD,CSE**

Mr.K Saibaba, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Course Title	**PROGRAMMING FOR PROBLEM SOLVING LABORATORY**				
Course Code	ACSC05				
Program	B.Tech				
Semester	II	CSE			
Course Type	Foundation				
Regulation	IARE - R20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Mr. Ravinder, Assistant Professor				

I COURSE OVERVIEW:

The course covers the basics of programming and demonstrates fundamental programming techniques, customs and terms including the most common library functions and the usage of the preprocessor. This course helps the students in gaining the knowledge to write simple C language applications, mathematical and engineering problems. This course helps to undertake future courses that assume this programming language as a background in computer programming. Topics include variables, data types, functions, control structures, pointers, strings, arrays and dynamic allocation principles. This course in reached to student by power point presentations, lecture notes, and lab involve the problem solving in mathematical and engineering areas..

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB02	II	-

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Computer Programming Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	The hands on experience in design, develop, implementation and evaluation by using Asymptotic notation.
II	The demonstration knowledge of basic abstract data types (ADT) and associated algorithms for organizing programs into modules using criteria that are based on the data structures of the program.

III	The practical implementation and usage of non linear data structures for solving problems of different domain.
IV	The knowledge of more sophisticated data structures to solve problems involving balanced binary search trees, AVL Trees, B-trees and B+ trees, hashing.
V	The graph traversals algorithms to solve real-world challenges such as finding shortest paths on huge maps and assembling genomes from millions of pieces

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** problem solving steps in terms of algorithms, pseudocode and flowcharts for Mathematical and Engineering problems. .	Understand
CO 2	**Make use** the concept of operators, precedence of operators, conditional statements and looping statements to solve real time applications.	Apply
CO 3	**Demonstrate** the concept of pointers, arrays and perform pointer arithmetic, and use the pre-processor.m.	Understand
CO 4	**Analyze** the complexity of problems, modularize the problems into small modules and then convert them into programs.	Apply
CO 5	**Implement** the programs with concept of file handling functions and pointer with real time applications of C.	Apply
CO 6	**Explore** the concepts of searching and sorting methods with real time applications using c	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL

VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:**Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Viva-voce/Laboratory Practices
PO 2	**Problem analysis:**Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Viva-voce/Laboratory Practices
PO 3	**Design/development of solutions:**Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Viva-voce/Laboratory Practices
PO 5	**Modern Tool Usage:**Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.	2	Viva-voce/Laboratory Practices
PO 10	**Communication:**Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	Viva-voce/Laboratory Practices
PO 12	**Life-long learning:**Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Viva-voce/Laboratory Practices

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking. .	2	Viva-voce Laboratory Practices
PSO 2	Focus on improving software reliability, network security or information retrieval systems .	2	Viva-voce Laboratory Practices

PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies. .	2	Viva-voce Laboratory Practices

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Understand (knowledge) the basic concept of algorithm analysis which provides theoretical estimates for the resources needed by any algorithm for a given computational problem. These estimates provide an insight into reasonable directions of search for efficient algorithms by applying the principles of **mathematics and science**	3
	PO 5	Understand the (given **knowledge**) appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineerig activities with an understanding of the limitations.	3
CO 2	PO 1	Understand (knowledge)the basic concept of algorithm analysis which provides theoretical estimates for the resources needed by any algorithm for a given computational problem. These estimates provide an insight into reasonable directions of search for efficient algorithms by applying the principles of **mathematics and science.**	3
	PO 5	Understand the (**knowledge**) appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.	2
CO 3	PO 1	Understand (**knowledge**) the basic concept of algorithm analysis which provides theoretical estimates for the resources needed by any algorithm for a given computational problem. These estimates provide an insight into reasonable directions of search for efficient algorithms by applying the principles of **mathematics and science.**	3
	PO 5	Understand the (knowledge) appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.	3
CO 4	PO 1	Describe (knowledge) the use sorting techniques as a basic building block in algorithm design and problem solving **using principles of mathematics, science, and engineering fundamentals.**	3
	PO 5	Understand the **knowledge** appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.	2

	PO 10	Apply (knowledge) concept of dimensional analysis and similarity parameters for predicting physical parameters (understanding) for the fluid flow analysis used in designing prototypes devices (apply) solving design problems by applying the **communicating effectively with engineering community.**	3
CO 5	PO 1	Outline the importance of searching algorithms to retrieve an element from any data structure where it is stored by **understanding and applying the fundamentals of mathematics, science and engineering.**	3
	PO 10	Understand the use of searching techniques that retrieve information stored within some data structure by **communicating effectively with engineering community**.	2
CO 6	PO 1	Outline the importance of searching algorithms to retrieve an element from any data structure where it is stored by **understanding and applying the fundamentals of mathematics, science and engineering**	2
	PO 10	Understand the use of searching techniques that retrieve information stored within some data structure by **communicating effectively with engineering communit.**	3
CO 7	PO 1	Make use of linear data structures to organize the data in a particular way so to use them in the most effective way by applying the **basic knowledge of mathematics, science, engineering fundamentals**	2
	PO 2	Build strong foundation of data Structures which tells the program how to store data in memory and forming some relations among the data and use them in **design and development of new products.**	2
	PO 3	Recognize the need of linear data structures such as linked list, array, stack and queue by **designing solutions for complex Engineering problems** in real-time.	1
	PSO 1	Acquire sufficient knowledge to develop real-time applications by making use of linear data structures in (**career building and higher studies.**	3
CO 8	PO 1	Describe (knowledge) the usage of data structures in organizing, managing, and storing different data formats that enables efficient access and modification by applying the **fundamentals of mathematics, science, and engineering.**	3
	PO 5	(**Modern Tool Usage:**)Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.	

	PO 3	Understand the applications of basic data structures such as stacks, queues, linked lists in (**designing and developing solutions of complex engineering applications.**	4
	PSO 1	Make use of modern computer tools for applying the basic data structure concepts in building real-time applications for a successful career.	
CO 9	PO 1	Apply the sophisticated hierarchical data structures to organize keys in form of a tree to use in many real-life applications by **using the principles of mathematics and engineering fundamentals.**	3
	PO 2	Make use of non-linear data structures such as balanced trees in by **identifying, formulating and analyzing complex engineering problems** such as databases, syntax tree in compilers and domain name servers etc. **with the help of basic mathematics and engineering sciences**.	3
	PO 3	Extend the concept of tree data structures to **design and develop solutions for complex engineering problems**.	3
	PSO 1	Make use of modern computer tools in implementing non-linear data structures for various applications to become a successful professional in the domain.	3
CO 10	PO 1	Demonstrate different tree structures in Python to implement real-time problems by **applying basic knowledge of science and engineering fundamentals.**	3
	PO 2	Illustrate the importance of tree data structures used for various applications **by identifying, formulating and analyzing complex engineering problems** such as operating systems and compiler design.	3
	PO 3	Make use of tree data structures to **design and develop solutions for complex engineering problems** and which is the key organizing factor in software design. Data structures can be used to organize the storage and retrieval of information stored in both main memory and secondary memory.	3
	PSO 1	Acquire sufficient knowledge in field of data structures and its applications by using modern computer tools so that new product development can take place, which leads to become successful entrepreneur and or to obtain higher education.	3
CO 11	PO 1	Understand (knowledge) the benefits of dynamic and static data structures implementations and choose appropriate data structure for specified problem domain **using knowledge of mathematics, science and engineering fundamentals.**	3
	PO 2	Recognize the need of dynamic and static data structures **in identifying, formulating and analyzing complex engineering problems.**	3

	PO 3	Describe (knowledge) the usage of static and dynamic data structures in designing solutions for complex Engineering problems.	3
	PSO 1	Build sufficient knowledge of dynamic data structures by using modern tools so that new product can be developed, which leads to become successful entrepreneur in the present market.	3
CO 12	PO 1	Build strong foundation of quickly determining the efficiency of an algorithm or data structure for solving computing problems with respect to performance by using knowledge of mathematics, science and engineering fundamentals.	3
	PO 2	Recognize the importance of suitable data structures in checking the efficiency of algorithms used for complex engineering problems.	3
	PO 3	Make use of broad usage of data structures in designing and developing of complex engineering applications.	3
	PSO 1	Extend the concept of data structures in solving complex engineering problems using modern engineering tools to become a successful professional in the domain.	3

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES				
	PO 2	PO 3	PO 5	PO 10	PSO 1
CO 1	3			2	
CO 2	3			2	
CO 3	3			2	3
CO 4	3			2	2
CO 5	2				2
CO 6	3				2
CO 7	3	2	2		2
CO 8	3		3	2	2
CO 9	2	2	3		2
CO 10	2	3	2		2
CO 11	3	2	2		2
CO 12	2	2	3		3

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**SEARCHING TECHNIQUES**
	Write python program for implementing the following searching techniques. a. Linear search. b. Binary search. c. Fibonacci search.
WEEK II	**SORTING TECHNIQUES**
	Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Bubble sort. b. Insertion sort. c. Selection sort.
WEEK III	**SORTING TECHNIQUES**
	Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Quick sort. b. Merge sort.
WEEK IV	**IMPLEMENTATION OF STACK AND QUEUE**
	Write Python programs to a. Design and implement Stack and its operations using Lists. b. Design and implement Queue and its operations using Lists
WEEK V	**APPLICATIONS OF STACK**
	Write Python programs for the following: a. Uses Stack operations to convert infix expression into postfix expression. b. Uses Stack operations for evaluating the postfix expression. .
WEEK VI	**IMPLEMENTATION OF SINGLE LINKED LIST**
	Write Python programs for the following: a. Uses functions to perform the following operations on single linked list. (i) Creation (ii) insertion (iii) deletion (iv) traversal b. To store a polynomial expression in memory using linked list. .
WEEK VII	**IMPLEMENTATION OF CIRCULAR SINGLE LINKED LIST**
	Write Python programs for the following: Uses functions to perform the following operations on Circular linked list. (i) Creation (ii) insertion (iii) deletion (iv) traversal .
WEEK VIII	**IMPLEMENTATION OF DOUBLE LINKED LIST**
	Write Python programs for the following: Uses functions to perform the following operations on double linked list. (i) Creation (ii) insertion (iii) deletion (iv) traversal in both ways .
WEEK IX	**IMPLEMENTATION OF STACK USING LINKED LIST**
	Write Python programs to implement stack using linked list.
WEEK X	**MPLEMENTATION OF QUEUE USING LINKED LIST**
	Write Python programs to implement queue using linked list
WEEK XI	**GRAPH TRAVERSAL TECHNIQUES**
	Write Python programs to implement the following graph traversal algorithms: a. Depth first search. b. Breadth first search.

WEEK XII	IMPLEMENTATION OF BINARY SEARCH TREE
	Write a Python program that uses functions to perform the following: a. Create a binary search tree. b. Traverse the above binary search tree recursively in pre-order, post-order and in-order. Count the number of nodes in the binary search tree.

TEXTBOOKS

1. Sutton, G.P., et al., —Rocket Propulsion Elements, John Wiley Sons Inc., New York, 1993
2. Martin J.L Turner , Rocket Space Craft Propulsion, Springers oraxis publishing, 2001

REFERENCE BOOKS:

1. Mathur, M., and Sharma, R.P., —Gas Turbines and Jet and Rocket Propulsion, Standard Publishers, New Delhi 1998
2. Cornelisse, J.W., Rocket Propulsion and Space Dynamics, J.W., Freeman & Co. Ltd., London, 1982.
3. Parker, E.R., Materials for Missiles and Spacecraft, McGraw-Hill Book Co. Inc., 1982.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Calibration of Venturimeter and Orifice meter.	CO 1	R1: 1.2
2	Determination of pipe flow losses in rectangular and circular pipes.	CO 2	R2: 3.5
3	Verification of Bernoulli's theorem	CO 3	R1: 3.4
4	Determination of Reynolds Number of fluid flow	CO 4	R1: 2.2
5	Determine the reaction forces produced by the change in momentum.	CO 5	R1: 2.4
6	Determine the efficiencyand draw theperformance curves ofcentrifugal pump.	CO 6	R3: 4.5
7	Determine the efficiencyand draw theperformance curves of reciprocating pump.	CO 6	R3: 4.6
8	Determine the performance characteristics of pelton wheel under constant head.	CO 6	R2: 5.1
9	Determine the performance characteristics of Francis turbine.	CO 6	R2: 5.2
10	Determine the rate of flow through weir.	CO 7	R1: 7.1
11	Determine the rate of flow through Nothches.	CO 7	R1:7.2
12	Determine the rate of flow through a Orifice meter	CO 7	R1:7.3

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	**Twin vortex formation:** Demonstration of twin vortex formation and calculation of vortex size for different geometries.

2	**Open channel:** Demonstration of streamline at different angle of attack and calculation of separation point for different Reynolds number.
3	**Capillary action:** By modeling capillary action using two cups of water and a paper towel, you'll gain a better understanding of the importance of this process in trees.
4	**Buoyancy** Calculation of meta center and displacement volume for various geometries and materials.
5	**Flow through pipes:** Encourage students to design and analyze flow through pipes using ANSYS

Signature of Course Coordinator **HOD,CSE**

Mr. P Ravinder, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**ANALOG AND DIGITAL ELECTRONICS**				
Course Code	AECC08				
Program	B.Tech				
Semester	III				
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr. B Ravi Kumar, Associate Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSB13	II	Semiconductor Physics

II COURSE OVERVIEW:

This course provides the basic knowledge over the construction and functionality of the basic electronic devices such as diodes and transistors. It also provides the information about the uncontrollable and controllable electronic switches and the flow of current through these switches in different biasing conditions and also will make them to learn the basic theory of switching circuits and their applications in specified relationship between signals at the input and output terminals. They will be able to design combinational and sequential circuits detail. Starting from a problem statement they will learn to design circuits of logic gates that have a.They will learn to design counters, adders, sequence detectors.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Digital Communications	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
%	Remember
%	Understand
%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

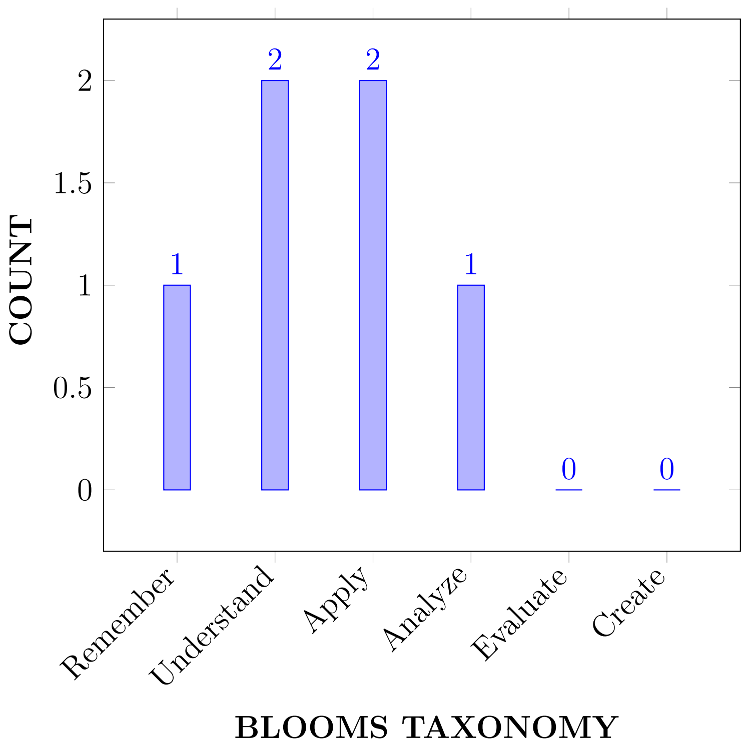
I	The Fundamental knowledge of the operational principles and characteristics of semiconductor devices and their applications.
II	The basic concept of number systems, boolean algebra and optimized implementation of combinational and sequential circuits.
III	The perceive subsequent studies in the area of microprocessors, microcontrollers, VLSI design and embedded systems effectively use of fundamentals of digital electronics.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Illustrate** the volt-ampere characteristics of semiconductor devices for finding cut-in voltage, resistance and capacitance.	Remember
CO 2	**Explain** half wave and full wave rectifier circuits with filter and without filters for conversion of alternating current in to direct current.	Understand
CO 3	**Analyse** the input and output characteristics of transistor configurations and small signal h-parameter models for determining the input - output resistances, current gain and voltage gain	Apply
CO 4	**Identify** the functionality of logic gates, parity code and hamming code techniques for error detection and correction of single bit in digital systems.	Understand
CO 5	**Construct** the combinational logic circuits using appropriate logic gates .	Apply
CO 6	**Implement** the synchronous and asynchronous counters for memory storing applications.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Program Outcomes	
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE/CIE/Quiz /AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	SEE/CIE/Quiz /AAT
PO 3	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	SEE/CIE/Quiz /AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking	2	Lectures and assignments.

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 4	✓	✓	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 5	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 6	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	**Recall(knowledge)** the semiconductor device properties **(knowledge)** for understanding conduction, Fermi-levels, barrier potentials through energy band diagrams, diffusion and drift currents in the device characteristics by applying the principles of **science**	3
	PO 2	**Understand** the given **problem statement** and **formulate** the static and dynamic resistance from the volt-ampere characteristics of the semiconductor devices using **first principles of mathematics, natural sciences, and engineering sciences**	4
	PO 10	Understand **problem statement** and solve it for dynamic resistance then **present it in the project**.	2
CO 2	PO 1	**Apply (knowledge)** the given the diode application **problem statement** and finding the **solution implementation** of rectifier circuits	3
	PO 2	**Formulate** and **analyze (Problem analysis) complex Engineering problems** and apply best rectifier of **engineering mathematics, design** and the results in terms of computational complexity.	6

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	Understand **problem statement** and solve it using ripple factor and effieciency then **present it in the project**.	2
CO 3	PO 1	**Apply** the **knowledge of mathematics, science, Engineering fundamentals** to understandtransistor configurations	3
	PO 2	**Identify** the given **problem statement** and formulate the required steps and **implement** (complex) amplifier circuits from the h-parameter model **information and data. Validate** one transistor design with other design in reaching substantiated conclusions by the **interpretation of results.**	6
	PO 3	**Design** ce configuration for determining voltage gain ,current gain input impedance and output impedance by applying the principles of **mathematics, science to the solutions of complex engineering problems and design system components.**	5
	PO 10	**Design** transistor configuration by applying h-parameters and the principles of of complex engineering problems and design system components.**applied in journals**	2
	PSO 1	**Apply** h- parameter model to analyze the transistor characheristics and presente it in concept videos	1
CO 4	PO 1	Basic **knowledge** of **science and mathematics is** needed to understand arrore detection and correction and then **apply** design hamming code.	3
	PO 2	**Identify** the probem **statement** of multigate realizations with **data** specification. **Implement** of boolean functions and **interpretation** of results.	4
	PO 10	**Design** solutions for logic circuits and **presented well in concept video**	2
CO 5	PO 1	Understand (knowledge) concept of boolean algebra and logic gates from **Engineering and Science of mathematical principles.**	3
	PO 2	**Identify** the problem **statement** of combinational logic circuitsr provided with **data** specification. **Make use of**k-map and truth table concepts in the **design of system components** combinational circuits to establish innovative solutions **for complex engineering problems**	6

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	**Design** the problem of combinational logic circuitsr provided with **data** specification. **Make use of**k-map and truth table concepts in the **design of system components** combinational circuits to establish innovative solutions **for complex engineering problems**	6
	PO 10	**Identify** the problem **statement** of combinational logic designs provided with **data** specification.	2
	PSO 1	Understand the boolean algebra and - map **apply** combinational design stepsand r research based learning	1
CO 6	PO 1	**Understand (knowledge)** concept of flipflops and sequential log circuits apply **Engineering and Science of mathematical principles.**	3
	PO 2	**Identify** the **problem statement** of sequential circuits **implementing counter**(analyze complex engineering problems) **on digitalcircuits(engineering sciences)**. conclusions by the **interpretation of results.**	6
	PO 3	**Design** the problem of seqential logic circuitsr provided with **data** specification. **Make use of** truth table and excitation table concepts in the **design of system components** seqential circuits to establish innovative solutions **for complex engineering problems**	6
	PO 10	**Identify** the **problem statement** of seqential circuits and **implementing** for memory applications .	2
	PSO 1	Understand the seqential circuits and **apply** sequential design steps and used in research based learning	1

Note: For Key Attributes refer **Annexure - I**

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	8	2	2	2
CO 1	3	4	-	-	-	-	-	-	-	2	-		-	-	-
CO 2	3	6	-	-	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	6	5	-	-	-	-	-	-	2	-	-	1	-	-
CO 4	3	4	-	-	-	-	-	-	-	2	-		-	-	-
CO 5	3	6	6	-	-	-	-	-	-	2	-	-	1	-	-
CO 6	3	6	6	-	-	-	-	-	-	2	-		1	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	8	2	2	2
CO 1	100	40	-	-	-	-	-	-	-	40	-	-	-	-	-
CO 2	100	60	-	-	-	-	-	-	-	40	-	-	-	-	-
CO 3	100	60	50	-	-	-	-	-	-	40	-	-	50	-	-
CO 4	100	40	-	-	-	-	-	-	-	40	-		-	-	-
CO 5	100	60	60	-	-	-	-	-	-	40	-	-	50	-	-
CO 6	100	60	60	-	-	-	-	-	-	40	-	-	50	-	-

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, **0** being **no correlation**, **1** being the **low correlation**, **2** being **medium correlation** and **3** being **high correlation**.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -5 $< C \leq 40\%$ – Low/ Slight
2 - 40 % $< C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	2	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	2	-	-	2	-	-
CO 4	3	2	-	-	-	-	-	-	-	2	-		-	-	-
CO 5	3	3	3	-	-	-	-	-	-	2	-	-	2	-	-

CO 6	3	3	3	-	-	-	-	-	-	2	-	-	2	-	-
TOTAL	18	16	8	-	-	-	-	-	-	12	-	-	6	-	-
AVERAGE	**3.00**	**2.67**	**2.67**	-	-	-	-	-	-	**2**	-	-	**2**	-	-

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Assignments	✓
Quiz	✓	Tech - Talk	-	Certification	-
Term Paper	-	Seminars	-	Student Viva	-
Laboratory Practices	-	5 Minutes Video / Concept Video	-	Open Ended Experiments	-
Micro Projects	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✓	Assessment of mini projects by experts		

XVIII SYLLABUS:

MODULE I	**DIODE AND APPLICATIONS**
	Diode - Static and Dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances, Diode Applications: Switch-Switching times. Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive Filter.
MODULE II	**BIPOLAR JUNCTION TRANSISTOR (BJT)**
	Principle of Operation and characteristics - Common Emitter, Common Base, Common Collector Configurations, Operating point, DC and AC load lines, Transistor Hybrid parameter model, Determination of h-parameters from transistor characteristics, Conversion of h-parameters.
MODULE III	**NUMBER SYSTEMS**
	Number systems, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties, Parity check code and Hamming code. Boolean Algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.
MODULE IV	**MINIMIZATION OF BOOLEAN FUNCTIONS**
	Karnaugh Map Method - Up to five Variables, Don't Care Map Entries, Tabular Method, Combinational Logic Circuits: Adders, Subtractors, comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations

MODULE V	**SEQUENTIAL CIRCUITS FUNDAMENTALS**
	Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another. Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters. .

TEXTBOOKS

1. Electronic Devices and Circuits "Jacob Millman", McGraw Hill Education, 2017

2. Electronic Devices and Circuits theory "Robert L. Boylestead, Louis Nashelsky",11th Edition, Pearson, 2009.

3. Switching and Finite Automata Theory, "Zvi Kohavi and Niraj K. Jha, 3rd Edition", Cambridge, 2010.

4. Modern Digital Electronics, "R. P. Jain, 3rd Edition", Tata McGraw-Hill, 2007.

REFERENCE BOOKS:

1. 1. Pulse, Digital and Switching Waveforms, "J. Millman, H. Taub and Mothiki S. Prakash Rao", 2 Ed., McGraw Hill, 2008.

2. 2. Electronic Devices and Circuits, "S. Salivahanan, N.Suresh Kumar, A Vallvaraj, 2nd Edition", TMH.

3. 3. Digital Design, "Morris Mano", PHI, 4th Edition,2006

4. 4. Introduction to Switching Theory and Logic Design, "Fredriac J. Hill, Gerald R. Peterson", 3rd Ed, John Wiley and Sons Inc.

COURSE WEB PAGE:

1. http://www.ebooks directory.com

2. http://Campus guides.lib.utah.edu

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	Course Out-comes	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
2	Introduction to semiconductors, Diode - Static and Dynamic resistances	CO 1	T1:2.1-2.3
3	Equivalent circuit, Load line analysis.	CO 1	T1:2.4,7.5
5	Diffusion and Transition Capacitances, Diode Applications, Switch-Switching times	CO 1	T1:2.7,7.3
8	Design Rectifier - Half Wave Rectifier and problems	CO 1	T1:2.8
10	Design Full Wave Rectifier and problems	CO 2	T1:3.2 R1:3.1-3.2
11	Design Bridge Rectifier, Rectifiers with Capacitive Filter	CO 2	T1:4.2
14	Understand the concepts of Transistor operation	CO 3	T1:8.1 R2:4.5
15	Characteristics of CB	CO 3	T1:8.3-8.7
18	Characteristics of CE	CO 4	T1:8.7-8.9
19	Characteristics of CC	CO 4	T1:10.2.1-2.3
20	Operating point, DC and AC load line Analysis and problems	CO 4	T1:10.2.4 R2:7.6
21	Transistor Hybrid parameter model, Determination of h-parameters from transistor characteristics, .	CO 4	T1:11.1-11.5
22	Conversion of h-parameters	CO 4	T1:11.4
23	Understand the need for digital systems, review of number systems, number base conversion	CO 5	T1:11.9
24	Complements of numbers, Weighted codes and Non-weighted codes.	CO 4	T1:9.4-9.6
25	Error detecting and correcting codes, Digital Logic Gates	CO 5	T1:9.7-9.10
32	Basic Theorems and Properties, Algebraic Simplification,	CO 4	T1:12.1-12.3
33	Canonical and Standard Form	CO 4	T1:12.3,7.3
34	Universal Gates, Multilevel NAND/NOR realizations.	CO 4	T1:12.4

37	Identify basic building blocks of digital systems and Minimization using three variable; four variable; five variable K-Maps; Don't Care Conditions.	CO 6	T1:12.3-12.5
38	Understand Tabular Method	CO 6	T1:12.6
39	Design Combinational Logic Circuits adders, subtractors.	CO 6	T1:12.7 R1:3.1
40	Design different combinational logic circuits comparators Multiplexers, Demultiplexer.	CO 4	T1:7.2
41	Demonstrate the Encoders, Decoders.	CO 4	T1:12.8 R2:4.5
42	Code converters, Hazards and Hazard Free Relations	CO 5	T1:12.9-12.10
43	Combinational and sequential circuits, the binary cell, the Fundamentals of sequential machine operation, SR-Latch	CO 5	T1:12.11-12.12
44	Flip Flops: SR, JK, JK Master Slave, D	CO 5	T1:12.13-12.14
45	T Type Flip Flops. Timing and Triggering	CO 5	T1:12.15 R2:7.6
46	Excitation tables of Flip-flops,	CO 5	T1:12.16-12.17
47	Conversion from one type of Flip-Flop to another	CO 5	T1:13.1 R2:8.1
48	Draw and explain about Shift Registers	CO 6	T1:13.2 R2:8.2
49	Implement snchounous counter:binary counter	CO 6	T1:13.3 R2:8.3
50	Implement snchounous counter:up down counter	CO 6	T1:13.4 R2:8.4
51	Implement snchounous counterr	CO 6	T1:13.5 R2:8.5
52	Implement snchounous counter	CO 6	T1:13.6 R2:8.6
53	Asynchronous Counters using flip flops	CO 6	T1:14.1 R3:7.1
54	Asynchronous Counters using flip flops :ring counter	CO 6	T1:14.2 R3:7.2
55	Asynchronous Counters using flip flops : johnson counter	CO 6	T1:14.3 R3:7.3
56	Asynchronous Counters using flip flops	CO 6, CO 6	T1:14.4 R3:7.4
PROBLEM SOLVING/ CASE STUDIES			
6	Dynamic resistance	CO 1	T2:1.12
7	Diode current equation	CO 1	T1:2.2
9	Half wave and full wave rectifier	CO 1	T2:1.12
12	Transistor configurations: CE, CB and CC	CO 2	T1:3.2
13	H-parameter model for transistor configurations	CO 2	T1:3.2
16	Conversion of h-parameters	CO 3	T1: 9.2-9.3
17	Number systems	CO 3	T1: 9.2-9.3
26	Weighted and non weighted codes	CO 4	T1: 7.2
27	Boolean algebra	CO 4	T1: 7.2
28	Logics gates and multilevel gates	CO 4	T1: 7.2
29	minimization of boolean function using K-map	CO 5	T1: 8.1
30	Combinational circuits	CO 5	T1: 8.1

31	FlipFlops	CO 5	T1: 8.1
35	Conversion between flipflop	CO 6	T1: 10.3
36	Snchrounous counter	CO 6	T1: 10.3
57	ASnchrounous counter	CO 6	T1: 10.3
DISCUSSION OF DEFINITION AND TERMINOLOGY			
58	Dynamic resistance	CO1	T2:1.12
59	Cutin voltage	CO1	T1:7.2, T1:8.1
60	Rectifier	CO 6	T1:10.2,T1:10.3
61	H- parameter model	CO 5,CO 5	T1:11.6
62	Voltage gain, current gain input resitance and output resitance	CO 6	T1:9.4-9.6
DISCUSSION OF QUESTION BANK			
63	number system	CO1,CO2	T2:1.12, T1:3.2
64	logic gates	CO 2	T1: 9.2-9.3
65	hamming code	CO3,CO4	T1:7.2, T1:8.1
66	combinational circuits	CO 5	T1:10.2,T1:10.3
67	latch and flipflops	CO 4, CO 5	T1: 11.6

Signature of Course Coordinator **HOD,CSE**
Dr. B Ravi Kumar, Associate professor

ANNEXURE - I

KEY ATTRIBUTES FOR ASSESSING PROGRAM OUTCOMES

PO Number	NBA Statement / Key Competencies Features (KCF)	No. of KCF's
PO 1	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems **(Engineering Knowledge).** Knowledge, understanding and application of 1. Scientific principles and methodology. 2. Mathematical principles. 3. Own and / or other engineering disciplines to integrate / support study of their own engineering discipline.	3
PO 2	Identify, formulate, review research literature, and analyse complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences (**Problem Analysis).** 1. Problem or opportunity identification 2. Problem statement and system definition 3. Problem formulation and abstraction 4. Information and data collection 5. Model translation 6. Validation 7. Experimental design 8. Solution development or experimentation / Implementation 9. Interpretation of results 10. Documentation	**10**
PO 3	Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations (**Design/Development of Solutions).** 1. Investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues 2. Understand customer and user needs and the importance of considerations such as aesthetics 3. Identify and manage cost drivers 4. Use creativity to establish innovative solutions	**10**

	5. Ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal 6. Manage the design process and evaluate outcomes. 7. Knowledge and understanding of commercial and economic context of engineering processes 8. Knowledge of management techniques which may be used to achieve engineering objectives within that context 9. Understanding of the requirement for engineering activities to promote sustainable development 10. Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	
PO 4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions (**Conduct Investigations of Complex Problems).** 1. Knowledge of characteristics of particular materials, equipment, processes, or products 2. Workshop and laboratory skills 3. Understanding of contexts in which engineering knowledge can be applied (example, operations and management, technology development, etc.) 4. Understanding use of technical literature and other information sources Awareness of nature of intellectual property and contractual issues 5. Understanding of appropriate codes of practice and industry standards 6. Awareness of quality issues 7. Ability to work with technical uncertainty 8. Understanding of engineering principles and the ability to apply them to analyse key engineering processes 9. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modeling techniques 10. Ability to apply quantitative methods and computer software relevant to their engineering discipline, in order to solve engineering problems 11. Understanding of and ability to apply a systems approach to engineering problems.	**11**
PO 5	Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations **(Modern Tool Usage).** 1. Computer software / simulation packages / diagnostic equipment / technical library resources / literature search tools.	**1**

PO 6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice (**The Engineer and Society).** 1. Knowledge and understanding of commercial and economic context of engineering processes 2. Knowledge of management techniques which may be used to achieve engineering objectives within that context 3. Understanding of the requirement for engineering activities to promote sustainable development 4. Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues 5. Understanding of the need for a high level of professional and ethical conduct in engineering.	**5**
PO 7	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development (**Environment and Sustainability).** Impact of the professional Engineering solutions (Not technical) 1. Socio economic 2. Political 3. Environmental	**3**
PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice (**Ethics).** 1. Comprises four components: ability to make informed ethical choices, knowledge of professional codes of ethics, evaluates the ethical dimensions of professional practice, and demonstrates ethical behavior. 2. Stood up for what they believed in 3. High degree of trust and integrity	**3**
PO 9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings (**Individual and Teamwork).** 1. Independence 2. Maturity – requiring only the achievement of goals to drive their performance 3. Self-direction (take a vaguely defined problem and systematically work to resolution) 4. Teams are used during the classroom periods, in the hands-on labs, and in the design projects. 5. Some teams change for eight-week industry oriented Mini-Project, and for the seventeen -week design project.	**12**

	6. Instruction on effective teamwork and project management is provided along with an appropriate textbook for reference 7. Teamwork is important not only for helping the students know their classmates but also in completing assignments. 8. Students also are responsible for evaluating each other's performance, which is then reflected in the final grade. 9. Subjective evidence from senior students shows that the friendships and teamwork extends into the Junior years, and for some of those students, the friendships continue into the workplace after graduation 10. Ability to work with all levels of people in an organization 11. Ability to get along with others 12. Demonstrated ability to work well with a team	
PO 10	Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (**Communication).** "Students should demonstrate the ability to communicate effectively in writing / Orally" 1. Clarity (Writing) 2. Grammar/Punctuation (Writing) 3. References (Writing) 4. Speaking Style (Oral) 5. Subject Matter (Oral)	**5**
PO 11	Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments (**Project Management and Finance).** 1. Scope Statement 2. Critical Success Factors 3. Deliverables 4. Work Breakdown Structure 5. Schedule 6. Budget 7. Quality 8. Human Resources Plan 9. Stakeholder List 10. Communication 11. Risk Register 12. Procurement Plan	**12**

PO 12	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change (**Life - Long Learning).** 1. Project management professional certification / MBA 2. Begin work on advanced degree 3. Keeping current in CSE and advanced engineering concepts 4. Personal continuing education efforts 5. Ongoing learning – stays up with industry trends/ new technology 6. Continued personal development 7. Have learned at least 2-3 new significant skills 8. Have taken up to 80 hours (2 weeks) training per year	**8**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**Computer Science and Engineering**				
Course Title	**PROGRAMMING WITH OBJECTS**				
Course Code	AITC02				
Program	B.Tech				
Semester	III				
Course Type	Core				
Regulation	UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	0	3	3	1.5
Course Coordinator	Mr.N.V.Krishna Rao, Assistant Professorr				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACS001	I	Computer Programming

II COURSE OVERVIEW:

This course presents the principles of object oriented programming using the Java language, one of the most increasingly preferred languages for programming today. The knowledge gained in this course can be applied later to other languages such as python, C++. This course uses Net beans IDE to afford a more interactive experience. This course helps to develop different applications in various domains like GUI Applications, BigData, Web-based Applications,etc..

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Object Oriented Programming Through JAVA	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
45 %	Understand
18 %	Apply
27 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

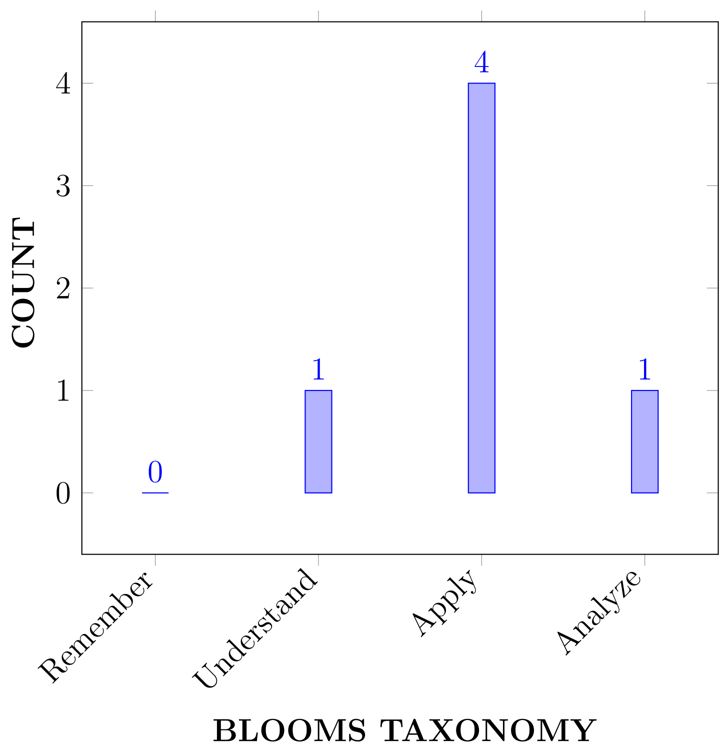
I	The basic concepts and principles of object oriented programming.
II	The object oriented features to develop the robust applications and database connectivity.
III	The Graphical User Interface (GUI) with multithreading concepts to develop real world applications on different platforms.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** object oriented programming concepts that helps to organize complex problems solving.	Understand
CO 2	**Make use of** the programming constructs like control Structures, arrays, parameter passing techniques and constructors to solve the real time problems.	Apply
CO 3	**Utilize** the abstraction,encapsulationand polymorphism Techniques to solve different complex problems.	Apply
CO 4	**Experiment** all threading and thread synchronization problems in soft real time systems.	Apply
CO 5	**Make use of** inheritance, interfaces, packages and files to implement reusability in soft real time systems.	Analyze
CO 6	**Construct** GUI based applications along with Exception handling using AWT, Swingand Applets with JDBC connectivity.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE /Quiz/CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	SEE /Quiz/ CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE /Quiz/ CIE / AAT
PO 10	**Communication:**Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions..	2	Discussion onInnovations /Presentation
PO 12	**Life-LongLearning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.	1	Short term courses

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	**Understand, design and analyze** computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	2	Quiz
PSO 3	**Make use of** high frequency structure simulator for modeling and evaluating the patch and smart antennas for wired and wireless communication applications.	3	Quiz

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	✓	-	-	✓	✓	-	-	-	-	-	-	✓	-	-	-
CO 3	✓	✓	-	✓	✓	-	-	-	-	-	-	✓	✓	-	-
CO 4	✓	✓	-	✓	✓	-	-	-	-	-	-	✓	✓	-	✓
CO 3	✓	✓	-	✓	✓	-	-	-	-	-	-	✓	✓	-	-
CO 6	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	**Recall** (Understand) the importance of programming language such as object oriented programming language applying **engineering fundamentals** and **provide solutions to engineering problems.**.	2
CO 2	PO 1	**Understand** the significance of object oriented programming to solve real world problems using **mathematical principles ,fundamental of Computer engineering specialization** and **scientific principles.**	3
	PO 4	**Understanding** use of technical literature and other information sources like constructors to solve the industry standards problems	4

	PO 5	**Understanding** of the limitations ofModern Tool Usage	1
	PO 12	**Build** Build strong foundation of programming schemes for career **building by communicating effectively with engineering concepts.**	3
CO 3	PO 1	**Understand** the importance of abstraction by applying **the knowledge of computer engineering fundamentals and mathematical principles.**	2
	PO 3	**Understand the problem** statement and **and choose appropriate techniques by analyzing** the importance of data hiding **interpretation of results.**	4
	PO 4	**Describe** use of technical literature and other information sources and inheritance , polymorphism techniques to solve the industry standards problems .	4
	PO 4	**Understanding** of the limitations ofModern Tool Usage	1
	PO 4	**Build** strong foundation of programming schemes for career **building by communicating effectively with engineering concepts.**	3
	PSO 3	**Describe** the importance of **Encapsulation for effective**use of available resources, to solve **complex Engineering problems and successful program execution.** complex Engineering problems and successful program execution.	6
CO 4	PO 1	**Describe** threads works independently and provides the **maximum utilization of the CPU, thus enhancing the CPU performance** overwhelming network issues	2
	PO 2	**Explain** and **demonstrate** the mechanics associated **with interprocess and intraprocess communication.**	4
	PO 4	**Understanding** use of technical literature and other information sourcesand threading and thread synchronization problems to solve the industry standards problems .	4
	PO 5	**Understanding** of the limitations ofModern Tool Usage	1
	PO 12	**Build** strong foundation of programming schemes for career **building by communicating effectively with engineering concepts.**	3
	PSO 1	**Understand** the concepts of **multithread,** elements of **parallel program execution and importance of CPU utilization**	3
	PSO 3	**Describe** the well utilization of **resources** for the better performance of the system.	1

CO 5	PO 1	**Describe**the relationship between parent class and child class, their behavior, properties and characterization by **understanding mathematical principles and scientific principles.**	2
	PO 2	**Describe**the **file handling** methods and analyze the various classes based on these file handling in javaprogramming.	4
	PO 4	**Understanding** use of technical literature and other information sourcesinheritance, interfaces to solve the industry standards problems .	4
	PO 5	**Understanding** of the limitations ofModern Tool Usage	1
	PO 12	**Build** strong foundation of programming schemes for career **building by communicating effectively with engineering concepts**	3
	PSO 1	**Design** and **Analyze** the operations and features of **file handling in the areas related to data storage, retrieval and update**	2
CO 6	PO 1	**Understand** the applet programming and Swing Programming to develop graphical user interfaces by applying the **knowledge of computer engineering fundamentals, mathematical principles, and scientific principles scientific principles**	3
	PO 2	**Analyze the process of compile time and runtime exception handling**	4
	PO 3	**Understand** the concepts of Exceptions for **innovative solutions; evaluate the solution of the complex issues.**	3
	PO 4	**Understanding** use of technical literature and other information sources inheritance, interfaces to solve the industry standards problems	4
	PO 5	**Understanding** of the limitations ofModern Tool Usage	1
	PO 10	**Build** strong foundation of programming Schemes for career **building by communicating effectively with engineering community**	4
	PO 12	**Build** strong foundation of programming schemes for career **building by communicating effectively with engineering concepts**	3
	PSO 1	**Classify**the exceptions for **robust program**	1
	PSO 3	**Make use of** computational and experimental tools for creating innovative paths for **AWT, Swings** and **JDBC connectivity**	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	12	2	2	2
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	-	-	4	1	-	-	-	-	-	-	3	-	-	-
CO 3	2	4	-	4	1	-	-	-	-	-	-	3	6	-	-
CO 4	2	4	-	4	1	-	-	-	-	-	-	3	3	-	1
CO 5	2	4	-	4	1	-	-	-	-	-	-	3	2	-	-
CO 6	3	4	3	4	1	-	-	-	-	4	-	3	1	-	2

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	12	2	2	2
CO 1	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	100	-	-	36	100	-	-	-	-	-	-	25	-	-	-
CO 3	67	40	-	36	100	-	-	-	-	-	-	25	100	-	-
CO 4	67	40	-	36	100	-	-	-	-	-	-	25	50	-	50
CO 5	67	40	-	36	100	-	-	-	-	-	-	25	33	-	-
CO 6	100	40	30	36	100	-	-	-	-	80	-	25	16	-	100

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, **0** being **no correlation**, **1** being the **low correlation**, **2** being **medium correlation** and **3** being **high correlation**.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	-	-	1	3	-	-	-	-	-	-	1	-	-	-
CO 3	3	2	-	1	3	-	-	-	-	-	-	1	3	-	-
CO 4	3	2	-	1	3	-	-	-	-	-	-	1	2	-	2

CO 5	3	2	-	1	3	-	-	-	-	-	-	1	2	-	-
CO 6	3	2	-	1	3	-	-	-	-	3	-	1	1	-	3
TOTAL	**18**	**8**	**1**	**5**	**15**	**-**	**-**	**-**	**-**	**3**	**-**	**5**	**8**	**-**	**5**
AVERAGE	**3**	**2**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**	**-**	**1**

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1, PO 2, PO 3, PO 4	SEE Exams	PO 1, PO 2, PO 3, PO 4	Assignments	PO 1, PO 2 ,P0 3, PO 4
Seminars	-	Student Viva	-	Certification	-
Laboratory Practices	-	5 Minutes Video	PO 4	Open Ended Experiments	-
Term Paper	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**OOP CONCEPTS AND JAVA PROGRAMMING**
	OOP concepts: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object oriented programming paradigm; Java programming: History of java, comments data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow statements, jump statements, simple java stand alone programs, arrays, console input and output, formatting output, constructors, methods, parameter passing, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection, exploring string class.
MODULE II	**INHERITANCE, INTERFACES AND PACKAGES**
	Inheritance: Inheritance hierarchies, superand subclasses, member access rules, super key word, preventing inheritance: final classes and methods, the object class and its methods; Polymorphism: Dynamic binding, method overriding, abstract classes and methods; Interface: Interfaces vs Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface; Packages: Defining, creating and accessing a package, understanding CLASSPATH, importing packages.

MODULE III	**EXCEPTION HANDLING AND MULTITHREADING**
	Exception Handling: Benefits of exception handling, the classification of exceptions, exception hierarchy, checked and unchecked exceptions, usage of try, catch, throw, throws and finally, re-throwing exceptions, exception specification, built in exceptions, creating own exception subclasses. Multithreading: Differences between multiple processes and multiplethreads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication.
MODULE IV	**FILES, AND CONNECTING TO DATABASE**
	Files: Streams, byte streams, character stream, text input/output, binary input/output, random access file operations, file management using file class; Connecting to Database: Connecting to a database, querying a database and processing the results, updating data with JDBC.
MODULE V	**GUI PROGRAMMING AND APPLETS**
	GUI programming with Java: The AWT class hierarchy, introduction to swing, swing Vs AWT, hierarchy for swing components, containers, JFrame, JApplet, JDialog, JPanel; Overview of some swing components: JButton, JLabel, JTextField, JTextArea, simple applications; Layout management: Layout manager types: Border, grid and flow; Applets: Inheritance hierarchy for applets, differences between applets andapplications,life cycle of an applet,passing parameters to applets.

TEXTBOOKS

1. Herbert Schildt, Dale Skrien, "Java Fundamentals– A Comprehensive Introduction", McGraw- Hill, 1^{st}Edition, 2013.

2. Herbert Schildt, "Java the Complete Reference", McGraw Hill, Osborne,8^{th}Edition, 2011.

3. T.Budd, "Understanding Object-Oriented Programming with Java", Pearson Education, Updated Edition(NewJava2Coverage), 1999.

REFERENCE BOOKS:

1. P.J.Deitel, H.M.Deitel, "Java: How to Program", Prentice Hall, 6^{th}Edition, 2005.

2. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press, CRCPress, 2007.

3. Bruce Eckel, "Thinking in Java", Prentice Hall,4^{th} Edition, 2006.

4. Sachin Malhotra, Saurabh Chaudhary, "Programming in Java", Oxford University Press, 2^{nd} Edition, 2014.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education(OBE): Course Objectives, Course Outcomes(CO), Program Outcomes(PO) and CO-PO Mapping	-	https://lms.iare.ac.in/index?route=course/details&course_id=188
CONTENT DELIVERY (THEORY)			
2	Object oriented paradigm - Basic concepts of Object Oriented Programming- Benefits of OOP -Applications of OOP	CO 1	T1:3-7
3-4	Java Evolution: Java Features-How Java differs from C and C++	CO 1	T1:3-7
5-6	OOP concepts: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism	CO 1	T1:9-13
7-8	Java programming: History of java, Comments, data types, variables, constants, scope and life time ofvariables,operators, operator hierarchy	CO 1	T1:17-39
9	Find Lattices, Hasse diagram, and inverse function composition of functions, recursive functions, Lattices as partially ordered sets; Definition and examples, properties of lattices, lattices as algebraic systems, sub lattices, direct product and homomorphism, some special lattices.		T1-5.14 to 5.15
9-10	Expressions, type conversion and casting, enumerated types, control flow statements, jump statements	CO 1	T1:73-151
11	Simple java stand-alone programs, arrays.	CO 2	T1-5.16 to 5.16
12	Console input and output, formatting output, constructors, and methods.	CO2	T1:73-151
13	Parameter passing, static fields and methods	CO 2	T1:73-151
14	Access control, this reference, example	CO 2	T1:73-151
15	Overloading methods and constructors	CO 4	T1:155-178
16	Recursion, garbage collection	CO 3	T1:155-178
17	Exploring string class.	CO 3	T1:155-178
18-19	Overloading methods and constructors-Access Control-Static members	CO 3	T1:156-188

20	Inheritance: Forms of inheritance – specialization, specification, construction, extension, limitation	CO 5	T1:189
21-22	Combination, benefits and costs of inheritance. Super uses- final - polymorphism, method overriding-dynamic method dispatch	CO 5	T1:190-216
23	Abstract classes and example	CO3	T1:190-216
24	Defining and accessing a package	CO5	T1:223-232
25	User defined package and example	CO5	T1:223-232
26	Understanding CLASSPATH, access protection importing packages	CO 5	T1:223-232
27-28	Interfaces-Defining and implementing an interface and extended interfaces	CO 5	T1:235–246
29	Exception Handling introduction	CO6	T1:249-263
30-31	Java Built in Exceptions and creating own exception subclasses.	CO4	T1:265–267
32	Java Thread life cycle model–Thread creation–Thread Exceptions–Thread Priority	CO 4	T1:273–275
33-34	Synchronization – Messaging – Runnable Interface–Inter thread Communication-	CO 4	T1:276-296
35-37	Suspending, Resuming and stopping thread, I/O Streams: File–Streams	CO 4,CO 5	T1:11.12 R2:7.1,7.2.3
38	Advantages–The stream classes–Byte streams	CO5	T1:11.10 R2:7.6
39	Character streams and example	CO 5	T1:11.10 R2:7.6
40	Connecting to Database: Connecting to a database, querying a database	CO6	T1:627-636
41	Example on JDBC connectivity	CO 6	T1:627-636
42	Processing the results, updating data with JDBC.	CO 6	T1:627-636
40	How Applets differ from Applications-Applet Life Cycle-	CO6	T1:627-636
43	Creating an Applet-Running the Applet	CO6	T1:627-636
44-45	Designing a Webpage-Applet Tag-Adding Applet to HTML file	CO 6	R2:9.4
46-47	Applet Tag Passing parameters to Applets	CO6	R2:9.4
48	Aligning the display and example	CO6	R2:9.4
50	Event handling: basics of event handling	CO 6	T1:735-748
51	Event classes, Event Listeners	CO 6	T1:735-748
52	Delegation event model, handling mouse	CO 6	T1:735-748
53	Keyboard events, adapter classes	CO 6	T1:735-748
54	The AWT class hierarchy, introduction to swing	CO 6	T1:735-748
55	Swing Vs AWT, hierarchy for swing components	CO 6	T1:735-748
56	AWT Class hierarchy, AWT Controls	CO 6	T1:735-748

57	Layout Managers and example	CO 6	T1:735-748
58	Menus, limitations of AWT	CO 6	T1:735-748
59	Write a java program to demonstrate a basic calculator using applet	CO 6	T1:735-748
60	Design and implement an applet that accepts two integer numbers and display the sum and difference of two numbers	CO 6	T1:735-748
PROBLEM SOLVING/ CASE STUDIES			
1	Describe the primitive data types supported in java and write a java program to print first 100 Fibonacci numbers	CO 1	T1:73-151
8	Write a do-while loop that asks the user to enter two numbers. The numbers should be added and the sum displayed. The loop should ask the user whether he or she wishes to perform the operation again. If so, the loop should repeat; otherwise it should terminate	CO1	T1:73-151
3	Write a program in Java which enters five numbers in an array using command line arguments and print sum and average of the numbers.	CO2	T1:73-151
4	Write a java program to create an abstract class named shape that contains two integers and an empty method named printarea(). Provide three classes named rectangle, triangle and circle such that each one of the classes extends the classshape. Each one of the classes contains only the method printarea () that prints the area of the given shape	CO 3	T1:189-246
5	Write a java program to handle the abnormal termination caused by an arithmetic expression having Division by zero	CO6	T1:249-296
6	Write a java program for the following scenario, Animal and Dog both classes have a common property color. If we print color property, it will print the color of current class by default. To access the parent property, we need to use super key word.	CO5	T1:627-636
7	Write a program to copy the content of one text file into another. The program accepts the name of the source file and the destination file from comm. And line. For example, to copy a file called FIRST.TXT to a file called SECOND.TXT.	CO 5	T1:627-636
8	Write a program that creates with reads. Fist thread prints the numbers from 1 to 100 and the other thread prints the numbers from 100 to 1	CO4	T1:249-296

9	Write a java program to handle abnormal termination caused be the following expression Int a[5]; // array size is5 a[6]=20/0;	CO 6	T1:249-296
10	Write a java program to handle abnormal termination caused by the expression	CO6	T1:249-296
11	Write a Java program to merge two files and display the merged file content	CO5	T1:11.12 R2:7.1,7.2.3
12	Write a java to implement method overloading and constructor overloading	CO3	T1:156-188
13	Write a java to implement method overriding and recursion	CO 3	T1:156-188
14	Write java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the Arithmetic operations. Add a text field to display the result. Handle any possible exception like divided by zero.	CO 6	T1:735-748
15	Describe events for handling a button click? Write a program for handling a button clicks?	CO6	T1:735-748
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Procedural language and OOP's	CO 1	T1:3-150
2	Inheritance, interfaces and packages	CO5	T1:189-246
3	Differentiate between multiprocessing and multithreading, methods of thread class.	CO4	T1:249-296
4	The steps to connect to the database in java	CO6	T1:735-748
5	Applet, swings and AWT components	CO6	R2:9.4
DISCUSSION ON QUESTION BANK			
1	OOP CONCEPTS AND JAVA PROGRAMMING	CO1 CO 2 CO3	T1:3-150
2	INHERITANCE, INTERFACES AND PACKAGES	CO5	T1:189-246
3	EXCEPTION HANDLING AND MULTITHREADING	CO4, CO6	T1:249-296
4	FILES,ANDCONNECTINGTODATABASE	CO5, CO6	T1-13.1 to 13.3
5	GUI PROGRAMMING AND APPLETS	CO 6	T1:735-748

Course Coordinator **HOD,CSE**
Mr.N.V.Krishna Rao, Assistant Professorr

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**DISCRETE MATHEMATICAL STRUCTURES**				
Course Code	AITC01				
Program	B.Tech				
Semester	III				
Course Type	Core				
Regulation	R-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Mrs .V Divyavani, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSC08	II	Probability and statistics

II COURSE OVERVIEW:

The purpose of this course is to provide a clear understanding of the concepts that underlying fundamentals with emphasis on their applications to computer science. It highlights mathematical definitions and proofs as well as applicable methods. The contents include formal logic notation, proof methods; induction, well- ordering; sets, relations; growth of functions; permutations and combinations, counting principles, recurrence equations, trees and more general graphs.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Discrete Mathematical Structures	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
40 %	Understand
50 %	Apply
0 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

<table>
<tr><th colspan="2">Component</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td rowspan="4">CIA</td><td>Continuous Internal Examination – 1 (Mid-term)</td><td>10</td><td rowspan="4">30</td></tr>
<tr><td>Continuous Internal Examination – 2 (Mid-term)</td><td>10</td></tr>
<tr><td>AAT-1</td><td>5</td></tr>
<tr><td>AAT-2</td><td>5</td></tr>
<tr><td>SEE</td><td>Semester End Examination (SEE)</td><td>70</td><td>70</td></tr>
<tr><td colspan="3">Total Marks</td><td>100</td></tr>
</table>

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

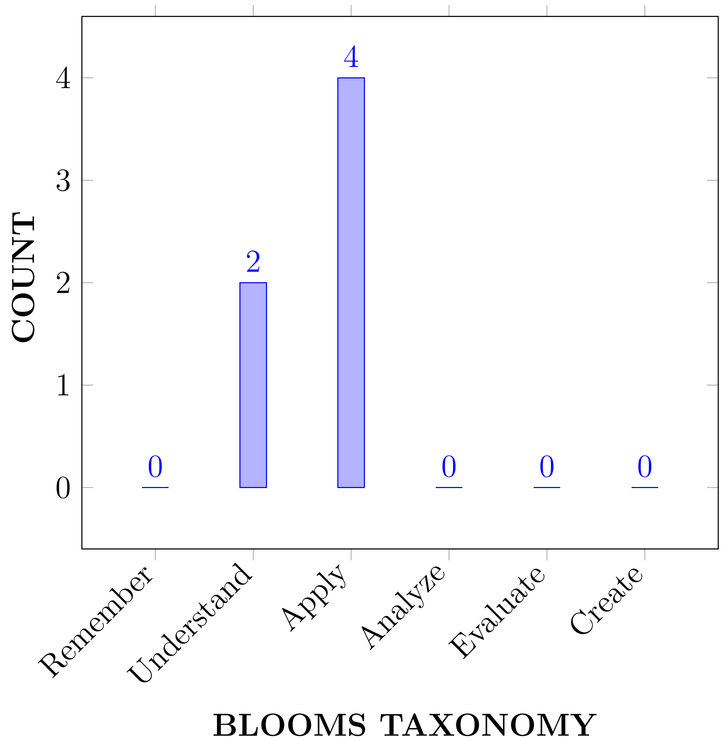
I	The fundamental knowledge of statement notations and logical connectives which are used to convert English sentences into logical expressions.
II	The effective use of combinatory principles for calculating probabilities and solving counting problems.
III	The characteristics of generating functions for finding the solution of linear homogeneous recurrence relations.
IV	The effective use of graph theory in subsequent fields of study such as computer networks, and algorithms for solving real world engineering problems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Make use of** mathematical definitions and its notations for reformulating statements in formal logic and validating normal forms.	Apply
CO 2	**Demonstrate** operations on discrete mathematical structures like sets, functions, lattices for representing the relations among them.	Understand
CO 3	**Illustrate** rings, integral domains, and field structures with binary operations defined on them.	Understand
CO 4	**Apply** addition rule and substitution rule for solving the problems of combinatorics.	Apply
CO 5	**Develop** solutions for recurrence relations and generating functions to obtain terms of equation.	Apply
CO 6	**Identify** appropriate algorithms of graphs and trees for finding shortest path.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	SEE / CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	3	SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		✓	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 4	✓	✓	-	-	-	-	-	-	-	-	-		-	-	-
CO 5	✓	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-
CO 6	✓	✓	✓	-	-	-	-	-	-	-	-		✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Apply the logical statements for the given problem with the help of truth tables and properties of logic by applying the mathematical principles and scientific principles.	2
	PSO 1	Remember the basic of properties of logic for designing algorithms, system software and knowledge discovery tools.	3
CO 2	PO 1	Make use of lattices, its properties and types for representing the finite sets in multidimensional applications by understanding mathematical principles, engineering principles specific to computer science and scientific principles.	3
	PO 2	Understand the given problem and develop the solution using recursive and inverse functions from the provided information and interpret of results.	4
	PSO 1	Make use of computational and experimental tools for creating system software, in data science and desire for higher studies in field of machine Learning and networking concepts	3
CO 3	PO 1	Apply the rules of inference, principle of inclusion and exclusion and automatic theorem for finding the proof of arguments by understanding mathematical principles and scientific principles.	2
	PO 2	Understand the given problem and choose appropriate technique (problem formulation) of lattices for solving the given problem from the provided Information and data in reaching substantiated conclusions by the interpretation of results.	4
	PSO 1	Solve the given problem, use creativity in applying the methods of graph models for innovative solutions and understand the economic context of the model analysis	4
CO 4	PO 1	Make use of lattices, its properties and types for representing the finite sets in multidimensional applications by understanding mathematical principles, engineering principles specific to computer science and scientific principles.	3
	PO 2	Understand the given problem and choose the suitable method of probability (problem formulation) for solving the given problem related to engineering from the provided information and data.	3
CO 5	PO 1	Make use of lattices, its properties and types for representing the finite sets in multidimensional applications by understanding mathematical principles, engineering principles specific to computer science and scientific principles.	3

	PO 2	Understand the given problem and develop the solution using recursive and inverse functions from the provided information and interpret of results.	4
	PO 3	Understand the user needs of given problem, use creativity in applying the methods of graph models for innovative solutions, evaluate the solution of the model, and understand the economic context of the model analysis.	5
	PSO 1	Analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	6
CO 6	PO 1	Make use of lattices, its properties and types for representing the finite sets in multidimensional applications by understanding mathematical principles, engineering principles specific to computer science and scientific principles.	3
	PO 2	Understand the given problem and choose appropriate technique (problem formulation) of lattices for solving the given problem from the provided Information and data in reaching substantiated conclusions by the interpretation of results.	4
	PO 3	Understand the user needs of given problem, use creativity in applying the methods of graph models for innovative solutions, evaluate the solution of the model, and understand the economic context of the model analysis.	5
	PSO 1	solve the given problem, use creativity in applying the methods of graph models for innovative solutions and understand the economic context of the model analysis.	4

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-		3	-	-
CO 2	3	4	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 3	2	4	-	-	-	-	-	-	-	-	-	-	4	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-		-	-	-
CO 5	3	4	5	-	-	-	-	-	-	-	-	-	6	-	-
CO 6	3	4	5	-	-	-	-	-	-	-	-		4	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.7	-	-	-	-	-	-	-	-	-	-		50.0	-	-
CO 2	100.0	40.0	-	-	-	-	-	-	-	-	-	-	50.0	-	-
CO 3	66.7	40.0	-	-	-	-	-	-	-	-	-	-	66.7	-	-
CO 4	100.0	30.0	-	-	-	-	-	-	-	-	-		-	-	-
CO 5	100.0	40.0	50.0	-	-	-	-	-	-	-	-	-	100.0	-	-
CO 6	100.0	40.0	50.0	-	-	-	-	-	-	-	-		66.7	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq$ C$\leq$ 5% – No correlation
1 -5 <C$\leq$ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% $\leq$ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-		2	-	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	3	1	-	-	-	-	-	-	-	-	-		-	-	-
CO 5	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO 6	3	2	2	-	-	-	-	-	-	-	-		3	-	-
TOTAL	18	9	4	-	-		-	-	-	-	-	-	13	-	-
AVERAGE	3.0	1.8	2.0	-	-		-	-	-	-	-	-	2.6 -	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	-	Open Ended Experiments	-
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**MATHEMATICAL LOGIC AND PREDICATES**
	Mathematical logic: Statements and notations, connectives, well-formed formulas, truth tables, tautology, equivalence implication; Normal forms: Disjunctive normal forms, conjunctive normal forms, principle disjunctive normal forms, principle conjunctive normal forms; Predicate calculus: Predicative logic, statement functions, variables and quantifiers, free and bound variables, rules of inference, consistency, proof of contradiction, automatic theorem proving. .
MODULE II	**RELATIONS, FUNCTIONS AND LATTICES**
	Relations: Properties of binary relations, equivalence, compatibility and partial ordering relations, lattices, Hasse diagram; Functions: Inverse function, composition of functions, recursive functions; Lattices: Lattices as partially ordered sets; Definition and examples, properties of lattices, sub lattices, some special lattices
MODULE III	**ALGEBRAIC STRUCTURES AND COMBINATORICS**
	Algebraic structures: Algebraic systems, examples and general properties, semi groups and monoids, groups, sub groups, homomorphism, isomorphism, rings. Combinatory: The fundamental counting principles, permutations, disarrangements, combinations, permutations and combinations with repetitions, the binomial theorem, multinomial theorem, generalized inclusion exclusion principle
MODULE IV	**RECURRENCE RELATION**
	Recurrence relation: Generating functions, function of sequences calculating coefficient of generating function, recurrence relations, solving recurrence relation by substitution and generating functions, Characteristics roots solution of homogeneous recurrence relation.
MODULE V	**GRAPHS AND TREES**
	Graphs: Basic concepts of graphs, isomorphic graphs, Euler graphs, Hamiltonian graphs, planar graphs, graph coloring, digraphs, directed acyclic graphs, weighted digraphs, region graph, chromatic numbers; Trees: Trees, spanning trees, minimal spanning trees.

TEXTBOOKS

1. J. P. Tremblay, R. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw Hill, India, 1st Edition, 1997.

2. Joe L. Mott, Abraham Kandel, Theodore P. Baker, “Discrete Mathematics for Computer Scientists and Mathematics”, Prentice Hall of India Learning Private Limited, New Delhi, India, 2nd Edition, 2010.

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1. Kenneth H. Rosen, “Discrete Mathematics and Its Applications”, Tata McGraw-Hill, New Delhi, India, 6th Edition, 2012.

2. D S Chandrashekaraiah, “Mathematical Foundations of Computer Science (Discrete Structures)”, Prism Books Pvt. Ltd., 2nd Reprint, 2007.

3. C. L. Liu, D. P. Mohapatra, “Elements of Discrete Mathematics”, Tata McGraw-Hill, India, 3rd Edition, 2008.

4. Ralph P. Grimaldi, B. V. Ramana, "Discrete and Combinatorial Mathematics - An Applied Introduction", Pearson Education, India, 5th Edition, 2011.
5. D. S. Malik, M. K. Sen, "Discrete Mathematical Structures: Theory and Applications", Thomson Course Technology, India, 1st Edition, 2004.

WEB REFERENCES:

1. http://www.web.stanford.edu/class/cs103x
2. http://www.saylor.org/course/cs202/.
3. http://www.cse.iitd.ernet.in/ bagchi/courses/discrete-book

COURSE WEB PAGE:

1. https://lms.iare.ac.in/index?route=course/details & course_id=413

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	https://lms.iare.ac.in/index ?route=course/details& course id=413
CONTENT DELIVERY (THEORY)			
1-3	Describe the statements and notations, connectives	CO 1	T1:1.1,1.2
4-6	Explain well-formed formulas, truth tables, tautology	CO 1	T1: 1.2.7, 1.2.8
7	Explain equivalence implications, DNF, CNF, PDNF, and PCNF.	CO 1	T1:1.2.9, 1.2.11, 1.3
8 – 14	Illustrate predicative logic, statement functions, variables and quantifiers, free and bound variables, rules of inference, consistency	CO 2, CO 3	T1:1.5, 1.4.2,1.4.3
15-20	Demonstrate proof of contradiction, automatic theorem proving, properties of binary relations, equivalence, transitive closure, Compatibility and partial ordering relations.	CO 2	T1:1.4.3, 1.4.4, 2.3.1, 2.3.2,2.3.6, 2.3.7,2.3.8
21-25	Find Lattices, Hasse diagram, and inverse function composition of functions, recursive functions, Lattices as partially ordered sets; Definition and examples, properties of lattices, lattices as algebraic systems, sub lattices, direct product and homomorphism, some special lattices.	CO 2	R2:4.3 T1:2.4.1, 2.4.2,2.4.3, 4.1
26-29	Demonstrate Algebraic systems, examples and general properties, semi groups and monoids, groups and subgroups, homomorphism, isomorphism, rings.	CO 3	T1:3.1,3.2 R1:6.2-6.8

30-35	Apply the fundamental counting principles, permutations, disarrangements, combinations, permutations and combinations with repetitions, the binomial theorem, multinomial theorem, generalized inclusion exclusion principle.	CO 4	R1: 7.1-7.6
36-38	Describe generating functions, function of sequences calculating coefficient of generating function.	CO 5	R2:8.1
39-44	Solve recurrence relations, solving recurrence relation by substitution and generating funds, Characteristics roots solution of homogeneous recurrence relation	CO 5	R2:8.2, 8.3
45-48	Explain basic concepts of graphs, isomorphic graphs.	CO 6	R2: 9.1-9.3
49-54	Describe Euler graphs, Hamiltonian graphs, planar graphs, graph coloring.	CO 6	R2: 9.8, 9.9, 10.1, 10.2
55-59	Describe digraphs, directed acyclic graphs, weighted digraphs, region graph, and chromatic numbers.	CO 6	T2:5.5, 5.9, 5.10
60	Explain trees, spanning trees, minimal spanning trees.	CO 6	R2:10.4, 10.6,10.7
PROBLEM SOLVING/ CASE STUDIES			
1	Problems on Statements and notations	CO1	T2:2.1
2	Problems on connectives	CO1	T2:2.3
3	Problems on well-formed formulas	CO1	T2:2.3.1
4	Problems on truth tables.	CO1	T2:7.2,7.3
5	Problems on tautology.	CO1	T2:10.3.1
6	Problems on Normal forms.	CO 1	T2:13.3.2, 13.4.1
7	Problems on rules of inference	CO1	T2:17.1.1, 17.1.3
8	Problems on Relations.	CO2	T2:18.3.4, 18.3.4.1
9	Problems on lattices and Hasse diagram.	CO2	T2:22.12, 19.1.2
10	Problems on Functions and Algebraic structures. .	CO 3,CO4	T2:18.4, 18.4.3
11	Problems on Recurrence relation and Generating functions. .	CO 5	T2:19.2, 18.4.4
12	Problems on graphs and trees.	CO 6	T2:23.1.1, 23.1.3
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Defines about Set, subset, universal set, Commutative laws, relation, least upper bound, greatest lower bound, lattice and function	CO 1	T2:18.3.4, 18.3.4.1
2	Defines about Proposition, connectives, quantifiers, Propositional Logic, Contingency and implication	CO 2	T2:22.12, 19.1.2

3	Defines about Algebraic Structure, Semi Group, closure property, group , Abelian Group or Commutative group, ring isomorphism, ideal algebra, zero divisor of a ring	CO 3, CO 4	T2:18.4, 18.4.3
4	Recurrence relation, characteristic equation	CO 5	T2:19.2, 18.4.4
5	Graph, Vertices, Edges, undirected graphs, Cycles, Loop, Graph Coloring, Digraphs, complete bidirected, tournament, Planarity, Degree of a Vertex	CO 6	T2:23.1.1, 23.1.3
DISCUSSION ON QUESTION BANK			
1	Mathematical logic and predicates	CO 1	T2:18.3.4, 18.3.4.1
2	Relations ,Functions and lattices	CO 2	T2:22.12, 19.1.2
3	Algebraic Structures and combinatorics	CO3,CO4	T2:18.4, 18.4.3
4	Recurrence relations and generating functions	CO5	T2:19.2, 18.4.4
5	Graphs and trees	CO 6	T2:23.1.1, 23.1.3

Course Coordinator **HOD,CSE**
Mrs V.Divyavani, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**DATA STRUCTURES**				
Course Code	ACSC08				
Program	B.Tech				
Semester	III				
Course Type	Core				
Regulation	UG.20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	3	1.5
Course Coordinator	Dr V Sitharamulu, Associate Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC01	I	Python Programming

II COURSE OVERVIEW:

The course covers some of the general-purpose data structures and algorithms, and software development. Topics covered include managing complexity, analysis, static data structures, dynamic data structures and hashing mechanisms. The main objective of the course is to teach the students how to select and design data structures and algorithms that are appropriate for problems that they might encounter in real life. This course reaches to student by power point presentations, lecture notes, and lab which involve the problem solving in mathematical and engineering areas.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Data Structures	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	whiteboard		Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
60%	Understand
20%	Apply
10%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz \Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Quiz \AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course

is given in table.

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

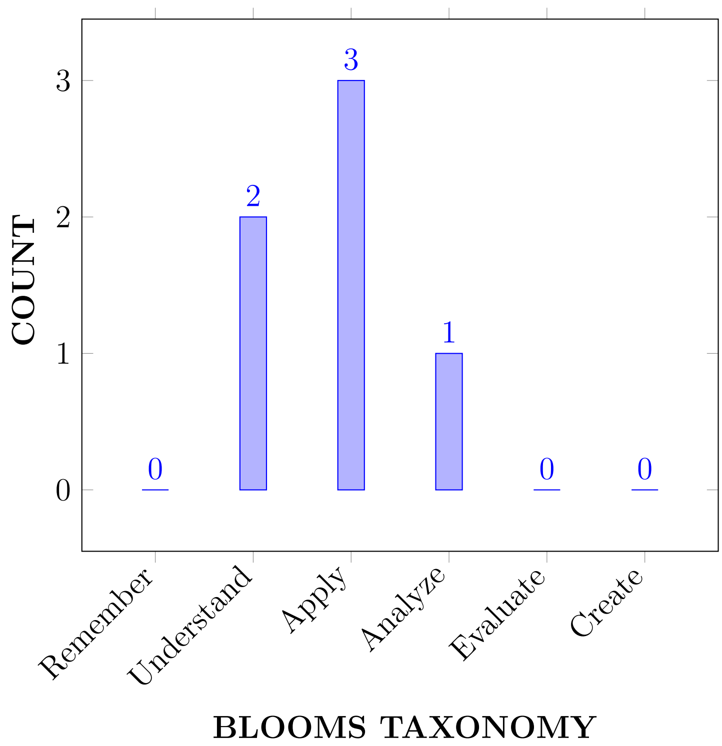
I	To provide students with skills needed to understand and analyze performance trade-offs of different algorithms / implementations and asymptotic analysis of their running time and memory usage.
II	To provide knowledge of basic abstract data types (ADT) and associated algorithms: stacks, queues, lists, tree, graphs, hashing and sorting, selection and searching.
III	The fundamentals of how to store, retrieve, and process data efficiently
IV	To provide practice by specifying and implementing these data structures and algorithms in Python.
V	Understand essential for future programming and software engineering courses.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Interpret** the complexity of algorithm using the asymptotic notations.	Understand
CO 2	**Select** appropriate searching and sorting technique for a given problem.	Apply
CO 3	**Construct** programs on performing operations on linear and nonlinear data structures for organization of a data	Apply
CO 4	**Make use of** linear data structures and nonlinear data structures solving real time applications.	Apply
CO 5	**Describe** hashing techniques and collision resolution methods for efficiently accessing data with respect to performance.	Understand
CO 6	**Compare** various types of data structures ; in terms of implementation, operations and performance.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Program Outcomes	
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	CIA/SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIA/SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	CIA/SEE
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	CIA/SEE

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	CIA/SEE/Open ended Experiments
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	Tech Talk/Concept Videos/Open ended Experiments
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	1	Tech Talk/Concept Videos/Open ended Experiments

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	**Understand** design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	3	CIA/ SEE/ Tech Talk/ Concept Videos
PSO 2	**Focus on** improving software reliability, network security information retrieval systems.	2	CIA/ SEE/ Tech Talk/ Concept Videos
PSO 3	**Make use of** modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	CIA/ SEE/ Tech Talk/ Concept Videos

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	✓
CO 2	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 5	✓	-	✓	-	✓	-	-	-	-	✓	-	-	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO1	PO 1	**Understand** (knowledge) the concept of conventional digital communication system and (understand) various types of pulse analog modulation techniques for signals analysis by applying the principles of **mathematics, science,** and **engineering fundamentals**.	3
	PO 2	**Problem Analysis** on different types of algorithms to analyze space and time complexities.	4
	PO 3	**Design the Solutions** for finding space and time complexities of a complex algorithm and representing it by asymptotic notations	2
	PO 10	**Subject matter and speaking style** assessed in explanation of various algorithms, algorithm complexity.	2
	PSO1	**Design and analyze** complex algorithms and specify its space and time complexities and representing it by asymptotic notations for faster processing of data.	3
	PSO3	**Make use of modern** computer tools for finding space and time complexities of a complex algorithm	1
CO 2	PO 1	**Make use** of broad knowledge of searching and sorting techniques for an efficient search from a data structure and optimize the efficiency of other algorithms by applying the knowledge of mathematics, science, Engineering fundamentals.	1
	PO 2	**Problem Analysis** on different types of search sort algorithms to analyze space and time complexities.	5

	PO 3	**Design/Development of Solutions** using appropriate searching and sorting techniques for designing a solution for complex Engineering problems.	2
	PO 5	**Implementation of**different sorting and searching techniques for given problem with the help of computer software	1
	PO 10	**Subject matter and speaking style** assessed in explanation of searching and sorting along with efficiency of searching and sorting techniques in terms of space and time complexity	2
	PO 12	**Keeping current in CSE and advanced engineering concepts** of various searching , sorting and respective time and space complexity by tech talk, concept videos and open ended experiments.	3
	PSO1	**Understand**complex problems and analyzing it and apply appropriate sorting and searching techniques for data processing.	4
	PSO2	**Applying**various selecting and sorting techniques while designing and developing information retrieval systems and its applications	2
	PSO3	**Make use of** various selecting and sorting techniques and extend the knowledge for advance frame works and platforms which are necessary for engineering practices and higher studies or become an entrepreneur.	1
CO 3	PO 1	**Make use of** linear and nonlinear data structures to organize the data in a particular way so to use them in the most effective way by applying the basic knowledge of mathematics, science, engineering fundamentals	2
	PO 2	**Problem analysis:** Organizing the given data in particular way by performing the operations on linear and nonlinear data structures to use the data in the most effective way.	7
	PO 3	**Recognize the** need of linear and nonlinear data structures such as linked list, array, stack and queue by Designing solutions for complex Engineering.	5
	PO 4	**Conduct Investigations** Conduct Investigations of Complex Problems: Ability to apply operations on linear and nonlinear data structures in order to organize the given data in a particular way	4
	PO 5	**Implementation of** Implementation of different operations on linear and nonlinear data structures for given problem with the help of computer software	1
	PO 10	**Subject matter and speaking style** assessed in explanation of linear and nonlinear data structures like linked lists, stacks and queues	2

	PO 12	**Keeping current in** CSE and advanced engineering concepts of linear and nonlinear data structures like linked lists, stacks and queues by tech talk, concept videos and open-ended experiments	3
	PSO1	**Understand** complex problems and analyzing it and apply appropriate operations on linear or nonlinear data structures for Developing the solution.	5
	PSO2	**Applying** various linear or nonlinear data structures while designing and developing information retrieval systems and its applications	2
	PSO3	**Make use of** various linear or nonlinear data structures and extend the knowledge for advance frame works and platforms which are necessary for engineering practices and higher studies or become an entrepreneur.	1
CO 4	PO 1	**Make use of** linear and nonlinear data structures for solving real time applications by applying the basic knowledge of mathematics, science, engineering fundamentals	3
	PO 2	**Problem analysis:**Solving real time applications by performing the operations on linear or nonlinear data structures.	7
	PO 3	**Recognize the** need of linear and nonlinear data structures such as linked list, array, stack and queue for Designing real time applications.	2
	PO 4	**Conduct Investigations of Complex Problems:** Ability to apply operations on linear or nonlinear data structures in order to solve real time applications.	4
	PO 5	**Implementation of** different operations on linear and nonlinear data structures for solving real time applications with the help of computer software	1
	PO 10	**Subject matter and speaking style** assessed in explanation of linear and nonlinear data structures like linked lists, stacks, queues, trees and graphs	2
	PO 12	**Keeping current** in CSE and advanced engineering concepts of linear and nonlinear data structures like linked lists, stacks, queues, trees and graphs by tech talk, concept videos and open-ended experiments for solving real time applications.	3
	PSO1	**Understand** complex problems and analyzing it and apply appropriate operations on linear or nonlinear data structures for solving real time applications.	5
	PSO2	**Applying** various linear or nonlinear data structures while designing and developing information retrieval systems and its applications	1

	PSO3	**Make use of** various linear or nonlinear data structures and extend the knowledge for advance frame works and platforms which are necessary for engineering practices and higher studies or become an entrepreneur.	1
CO 5	PO 1	**Understand** the knowledge of hashing techniques and collision resolution methods and implementing for specified problem domain using knowledge of mathematics, science and engineering fundamentals	1
	PO 3	**Design the Solution** for efficiently accessing data with respect to performance by using hashing techniques and collision resolution methods	2
	PO 5	**Implementation of** hashing techniques and collision resolution methods for efficiently accessing data with respect to performance with the help of computer software	1
	PO 10	**Subject matter and speaking style** assessed in explanation of Hashing, Collision techniques	2
	PSO1	**Understand** complex problems and analyzing it and apply appropriate hashing techniques and collision resolution methods for efficiently accessing data with respect to performance.	4
	PSO2	**Applying** various hashing techniques and collision resolution methods while designing and developing information retrieval systems and its applications	1
	PSO3	**Build** sufficient knowledge hashing techniques and collision resolution methods so that new product can be developed, which leads to become successful entrepreneur in the present market.	1
CO 6	PO 1	**Understand** various types of data structures in terms of implementations and choose appropriate data structure for specified problem domain using knowledge of mathematics, science and engineering fundamentals	3
	PO 2	**Problem Analysis:** Recognize the importance of suitable data structures in checking the efficiency of algorithms used for complex engineering problems.	7
	PO 3	**Design the Solution** complex problems or efficiently accessing data with respect to performance by using hashing techniques and collision resolution methods	5
	PO 4	**Conduct Investigations of Complex Problems:** Ability to apply operations on linear or nonlinear data structures in order to solve real time applications.	4
	PO 5	**Understand** the Implementation of various types of data structures with the help of computer software	1
	PO 10	**Subject matter and speaking** style assessed in explanation of Implementation of various types of data structures.	2

	PO 12	**Keeping current in CSE** and advanced engineering concepts of Implementation of various types of data structures by tech talk, concept videos and open ended experiments	3
	PSO 1	**Understand** complex problems and analyzing it and apply Implementation of various types of data structures.	5
	PSO 2	**Applying** Implementation of various types of data structures while designing and developing information retrieval systems and its applications	1
	PSO 3	**Build** sufficient knowledge Implementation of various types of data structures so that new product can be developed, which leads to become successful entrepreneur in the present market.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	12	6	2	2
CO 1	1	4	2	-	-	-	-	-	-	2	-	-	3	-	1
CO 2	1	5	2	-	1	-	-	-	-	2	-	3	4	2	1
CO 3	2	7	5	4	1	-	-	-	-	2	-	3	5	2	1
CO 4	3	7	2	4	1	-	-	-	-	2	-	3	5	1	1
CO 5	1	-	2	-	1	-	-	-	-	2	-	-	4	1	1
CO 6	3	7	5	4	1	-	-	-	-	2	-	3	5	1	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	12	2	2	2
CO 1	33.3	40	20	-	-	-	-	-	-	40	-	-	50	-	50
CO 2	33.3	50	20	-	100	-	-	-	-	40	-	25	66.6	100	50
CO 3	66.6	70	50	36.3	100	-	-	-	-	40	-	25	83.3	100	50
CO 4	100	70	20	36.3	100	-	-	-	-	40	-	-	66.6	50	50
CO 5	33.3	-	20	-	100	-	-	-	-	40	-	-	66.6	50	50
CO 6	100	70	50	36.3	100	-	-	-	-	40	-	25	83.3	50	50

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, **0** being **no correlation**, **1** being the **low correlation**, **2** being **medium correlation** and **3** being **high correlation**.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\ \% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	**PROGRAM OUTCOMES**												**PSO'S**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	-	-	-	-	-	-	1	-	-	2	-	2
CO 2	1	2	1	-	3	-	-	-	-	1	-	1	3	3	2
CO 3	3	3	2	1	3	-	-	-	-	1	-	1	3	3	2
CO 4	3	3	1	1	3	-	-	-	-	1	-	1	3	2	2
CO 5	1	-	1	-	3	-	-	-	-	1	-	-	3	2	2
CO 6	3	3	2	1	3	-	-	-	-	1	-	1	3	2	2
TOTAL	**12**	**12**	**8**	**3**	**15**	**-**	**-**	**-**	**-**	**6**	**-**	**4**	**17**	**12**	**12**
AVERAGE	**2.0**	**2.4**	**1.3**	**1.0**	**3.0**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2.8**	**2.4**	**2.0**

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Assignments	✓
Seminars	-	Student Viva	-	Certification	-
Laboratory Practices	-	5 Minutes Video	✓	Open Ended Experiments	-
Term Paper	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO DATA STRUCTURES, SEARCHING AND SORTING**
	Basic concepts: Introduction to data structures, classification of data structures, operations on data structures; Algorithms Specification ,Recursive algorithms ,Data Abstraction, Performance analysis-time complexity and space complexity, Asymptotic Notation-Big O ,Omega and Theta notations. Introduction to Linear and Non Linear data structures, Searching techniques: Linear search, Binary search; Sorting techniques: Bubble, Selection, Insertion, Quick and Merge Sort and comparison of sorting algorithms
MODULE II	**LINEAR DATA STRUCTURES**
	Stacks: Stack ADT, definition and operations, Implementations of stacks using array, applications of stacks, Arithmetic expression conversion and evaluation; Queues: Primitive operations; Implementation of queues using Arrays, applications of linear queue, circular queue and double ended queue (deque).
MODULE III	**LINKED LISTS**
	Linked lists: Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list; Applications of linked lists: Polynomial representation and sparse matrix manipulation. Types of linked lists: Circular linked lists, doubly linked lists; Linked list representation and operations of Stack, linked list representation and operations of queue
MODULE IV	**NON LINEAR DATA STRUCTURES**
	Trees: Basic concept, binary tree, binary tree representation, array and linked representations, binary tree traversal, binary tree variants, application of trees; Graphs: Basic concept, graph terminology, Graph representations-Adjacency matrix, Adjacency lists, graph implementation, Graph traversals-BFS,DFS, Application of graphs, Minimum spanning trees-Prims and Kruskal algorithms
MODULE V	**BINARY TREES AND HASHING**
	Binary search trees: Binary search trees, properties and operations; Balanced search trees: AVL trees; Introduction to M-Way search trees, B trees; Hashing and collision: Introduction, hash tables, hash functions, collisions, applications of hashing.

TEXTBOOKS

1. Rance D. Necaise, —Data Structures and Algorithms using Python, Wiley Student Edition.
2. Benjamin Baka, David Julian, —Python Data Structures and Algorithms, Packt Publishers, 2017.

REFERENCE BOOKS:

1. S. Lipschutz, —Data Structures , Tata McGraw Hill Education, 1st Edition, 2008.
2. D. Samanta, —Classic Data Structures, PHI Learning, 2nd Edition, 2004.

WEB REFERENCES:

1. http://www.tutorialspoint.com/data-structures-algorithms
2. https://www.geeksforgeeks.org/data-structures/
3. https://www.studytonight.com/data-structures/
4. https://www.coursera.org/specializations/data-structures-algorithms

COURSE WEB PAGE:

1. https://www.iare.ac.in/?q=courses/computer-science-and-engineering-autonomous/datastructures

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	https://www.iare.ac.in/?q=courses/computer-science-and-engineering-autonomous/datastructures
CONTENT DELIVERY (THEORY)			
1	Basic concepts: Introduction to Data Structures	CO 3	T1:1.1.3 R2 : 1.2
2	Classification of data structures	CO 3	T1:1.1.3 R2 : 1.4
3	Operations on data Structures	CO 3	T1:1.2
4	Recursive algorithm, Performance Analysis	CO 1	T1:1.2 T1:5.1
5	Searching techniques: Linear search and binary search	CO 2, CO 6	T1:5.1
6	Searching techniques: Fibonacci search and comparison	CO 2, CO 6	T1:5.1
8	Sorting techniques: Bubble sort, selection sort and companding	CO 2 CO 6	R1:14.5

9	Sorting techniques: Insertion sort, Quick sort	CO 2, CO 6,	T1:5.2 R2 : 10.2
10	Merge sort ,comparison of sorting algorithms	CO 4, CO 6	T1:5.2 R2 : 10.2
13	Stacks: Primitive operations, implementation of stacks using Arrays	CO 3, CO 4	T1:7.1
14	Applications of stacks arithmetic expression conversion and evaluation	CO 4, CO 6	T1:7.2
16	Queues: Primitive operations; Implementation of queues using Array	CO 3, CO 4	T1:8.1
17	Applications of linear queue, circular queue	CO 3, CO 4	T1:8.4
18	Double ended queue (deque)l	CO 3, CO 4	R2 : 5.4
19	Linked lists: Introduction, singly linked list, representation of a linked list in memory	CO 3, CO 4	T1:9.1
20	Operations on a single linked list :creation, insertion and deletion	CO 3, CO 4	T1:9.2
21	Applications of linked lists	CO 4,	T1:9.3
22	Operations on a double linked lists :creation, insertion and deletion	CO 3, CO 4	T1:9.4
23	Operations on a double linked lists : deletion ,traversal.	CO 3, CO 4	T1:9.4
24	single linked list :polynomial expression	CO 3, CO 4	T1:9.3
25	single linked list :Sparse matrix manipulation.	CO 3, CO 4	T1:9.3
26	Operations on a Circular linked lists: creation, insertion and deletion	CO 3, CO 4	T1:9
30	Operations on a Circular linked lists: deletion, traversal	CO 3, CO 4	T1:9
31	Linked list representation and operations of Stack	CO 3, CO 4	T1:9.7
32	Linked list representation and operations of queue	CO 3, CO 4	T1:9.8
37	Trees: Basic concept, Tree terminology	CO 3	T1:13.1

CONTENT DELIVERY (THEORY)			
38	Binary tree :Binary Tree properties	CO 3, CO 4	T1:13.1
39	Binary tree representation using array	CO 3, CO 4	T1:13.2
40	Binary tree representation using linked list	CO 3, CO 4	T1:13.2
41	Binary tree traversal, binary tree variants	CO 3, CO 4	T1:13.2
42	Application of trees	CO 4	T1:13.2.3
44	Graphs: Basic concept, graph terminology	CO 3	R2 : 8.2
45	Types of graphs, Representation of graph	CO 3	R2 : 8.2
46	Graph traversals :DFS and BFS, Application of graphs	CO 3	T2:6.2
48	Minimum Spanning Trees-Prims and Kruskal algorithms	CO 4	T1:6.1 T2:5.6
50	Binary search trees, properties	CO 3	T1:13.2.3
51	Binary search trees operations	CO 3	T1:13.2.3
52	AVL trees	CO 3	T1:14.3
53	M- Way search trees, B trees	CO 3	T1:14.3
54	Hashing, Collision	CO 5	R2 : 6.4
7	Problems on linear search, binary search and Fibonacci search.	CO 2	T1:5.1
11	Problems on bubble sort, selection and insertion sort	CO 3, CO 4	T1:5.2 R2 : 10.2
12	Problems on quick and merge sort	CO 3, CO 4	T1:5.2 R2 : 10.2
15	Problems on Arithmetic expression conversion and evaluation	CO 3, CO 4	T1:7.2
27	Problems on single linked list to add, delete element	CO 3, CO 4	T1:9.8
28	Problems on double linked list to add, delete element	CO 3, CO 4	T1:9.8
33	Problems on circular linked list to add, delete element	CO 3, CO 4	T1:9.4
34	Problems on double linked list to add, delete element	CO 3, CO 4	T1:9.3
35	Problems on stack using linked list	CO 3, CO 4	T1:9.7
36	Problems on queue using linked list	CO 3, CO 4	T1:9.8
43	Problems on Binary tree :creation ,insertion and deletion of a node	CO 3, CO 4	T1:13.2
47	Problems on Graph Traversal: DFS and BFS	CO 3, CO 4	T2:6.2

49	Problems on MST: Prim's and Kruskal's	CO 3, CO 4	T1:6.1 T2:5.6
55	Problems on Binary search tree	CO 4	T1:14.3
56	Problems oh hashing	CO 5	R2 : 6.4
DISCUSSION ON DEFINITION AND TERMINOLOGY			
57	Definitions on Data Structures, searching and sorting	CO 1,CO2,CO 3	T1:1 R1:14
58	Definitions on Linear Data Structures	CO 3	T1:7,.T1:8
59	Definitions on Linked Lists	CO 3	T1:9
60	Definitions on Non Linear data Structures	CO 3	T1:7.5
61	Definitions on Binary Trees and Hashing	CO 3 CO 5	T1:14
DISCUSSION ON QUESTION BANK			
62	Data Structures, searching and sorting	CO 1, CO2,CO6	T1:1 R1:14
63	Linear Data Structures	CO 3,CO 4,CO 6	T1:9
64	Linked Lists	CO 3,CO 4,CO 6	T1:2.5
65	Non Linear data Structures	CO 3,CO 4,CO 6	T1: 4.1
66	Binary Trees and Hashings	CO 3,CO 5,CO 6	T1: 5.1

Course Coordinator **HOD,CSE**
Dr V Sitharamulu, Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**COMPUTER ORGANIZATION AND ARCHITECTURE**				
Course Code	ACSC07				
Program	B.Tech				
Semester	III				
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Dr. P Cahandana, Associate Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSOO4	II	PROGRAMING FOR PROBLEM SOLVING

II COURSE OVERVIEW:

This course introduces the principles of basic computer organization, CPU organization, and the basic architecture concepts. The course emphasizes performance and cost analysis, instruction set design, register transfer languages, arithmetic, logic and shift micro-operations, pipelining, memory technology, memory hierarchy, virtual memory management, and I/O organization of computer, parallel processing and inter process communication and synchronization.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Computer Organization and Architecture	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	✓	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
45 %	Understand
18 %	Apply
27 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

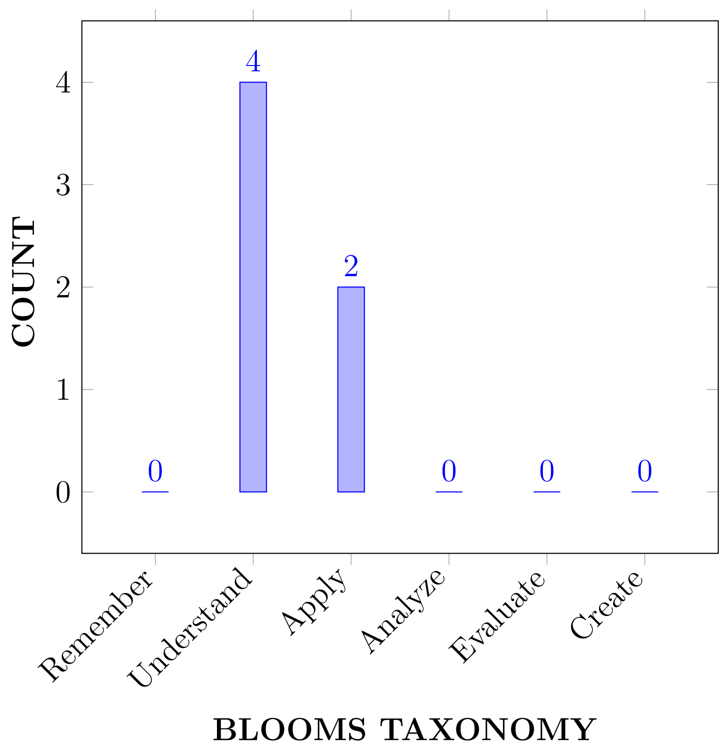
VI COURSE OBJECTIVES:
The students will try to learn:

I	Understand the organization and architecture of computer systems and electronic computers.
II	Study the assembly language program execution, instruction format and instruction cycle.
III	Design a simple computer using hardwired and micro-programmed control methods.
IV	Study the basic components of computer systems besides the computer arithmetic .
V	Understand input-output organization, memory organization and management, and pipelining.

VII COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1	**Illustrate** interaction of components in a computer system with functional units and levels of programming languages.	Understand
CO 2	**Demonstrate** the implementation of micro-operations with the help of register transfer language and electronic circuits.	Understand
CO 3	**Identify** appropriate addressing modes for specifying the location of an operand.	Apply
CO 4	**Make use of** number system for data representation and binary arithmetic in digital computers.	Apply
CO 5	**Interpret** the design of hardwired and micro-programmed control unit for execution of micro programs.	Understand
CO 6	**Summarize** the concepts of pipelining and interprocess communication for advanced processor design.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1	SEE / CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE / CIE / AAT
PO 4	**Conduct investigations of complex problems:**Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	SEE / CIE / AAT
PO 5	**Modern tool usage:**Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineeringactivities with an understanding of the limitations.	3	SEE / CIE / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	SEE / CIE / AAT
PO 12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	3	CIE/Quiz/ AAT
PSO 2	Focus on improving software reliability, network security or information retrieval systems	2	CIE/Quiz/ AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	CIE/Quiz /AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	✓	-	-	-	-	-	-	-	-		✓	✓	-
CO 2	✓	-	-	-	-	-	-	-	-	-	-	-	✓	✓	-
CO 3	✓	✓	✓	✓	-	-	-	-	-	✓	-	-	✓	-	-
CO 4	✓	✓	-	✓	-	-	-	-	-	✓	-	✓	✓	-	-
CO 5	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	-	✓
CO 6	✓	-	-	-	-	-	-	-	-	✓	-	✓	✓	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Explain the various functional units of Computer with computer science principles.	1
	PO 2	Explore the types of programming languages for problem identification and to formulate computer science and Engineering Problems.	2
	PO 3	Evaluate the instruction set architecture based on the cost drivers, integration, manage design process and understand customer needs..	4
	PSO 1	Understand levels of programming languages related to Software.	1
	PSO 2	Develop micro programs using instruction set architecture with a major focus on improving software reliability and information retrieval systems.	1

CO 2	PO1	Explore taxonomy of microoperations and RTL for micro program development by using the mathematical and computer science principles.	2
	PSO 1	Understand the notations of RTL related to Software.	4
	PSO 2	Develop assembly language programs with a major focus on improving software reliability and information retrieval systems.	3
CO 3	PO 1	Select appropriate addressing mode for finding effective address of operand using mathematical and computer science principles	2
	PO 2	Choose appropriate addressing mode for information and data collected from various sources memory locations or registers and perform microoperations and validation the results for interpretation	1
	PO 3	Classify the addressing modes in terms of defining various problems and understanding appropriate codes of practice.	3
	PO 4	Utilize Instruction set architecture of processors for designing assembly language programs through laboratory skills and technical literature.	2
	PO 10	Make use of variety of addressing modes to fetch operands for the development of assembly language program with clarity and semantics or grammar of the assembly language.	2
	PSO 1	Develop applications for specific problems by including huge volume of data and related to Software.	1
CO 4	PO 1	Explain the concept of data representation by applying mathematical and computer science principles.	3
	PO 2	Understand the data representation and computer arithmetic for understanding of appropriate codes to formulate, solve problem, document and interpretation of results.	6
	PO 3	Identify the appropriate representation of data suitable for customer needs, investigation of a problem, identify and manage architecture design process.	4
	PO 4	Communicate effectively in orally and written by comprehend and write effective reports and design documentation with the engineering community by having major focus on clarity on content, Grammar/Punctuation, appropriate References, good Speaking style and depth in subject matter.	2
	PO 10	Recognize the need for advanced concepts in binary arithmetic and algorithms for developing applications through continuing education efforts with ongoing learning – stays up with industry trends/ new technology and continued personal development in the broadest context of technological change	3
	PSO 1	Explain the technologies used to represent data and computer arithmetic related to Algorithms and architecture.	1

CO 5	PO 1	Design control unit by considering various issues and types risk assessment and analysis activity to identify and analyze root causes using computer science principles.	1
	PO 2	Design and develop hardwired and micro programmed control units with knowledge and uncertainty of commercial engineering process and management.	2
	PO 3	Design a control memory of system by investigating and defining various problems, understanding user needs.	3
	PO 4	Utilize micro instructions for designing assembly language programs through laboratory skills, technical literature, technical uncertainty and quality issues.	3
	PO 5	Experiment the design of control unit with Computer software or simulation packages.	2
	PO 10	Recognize the need for advanced concepts of control memory design and micro instructions based on micro architecture for developing applications through continuing education efforts with ongoing learning – stays up with industry trends/ new technology and continued personal development in the broadest context of technological change.	4
	PSO 1	Explain the design issues of control memory and micro instruction format used to develop micro program related to Algorithms and architecture.	1
	PSO 3	Develop micro programs and support design of control memory by using modern computer software and simulation tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	1
CO 6	PO 1	Understand the concept of pipelining to improve performance of the system by applying mathematical principles and computer science methodologies.	2
	PO 10	Communicate in written form by comprehending and writing effective reports and design documentation advanced micro architectures with the engineering community by having major focus on clarity on content, Grammar/Punctuation, good Speaking style	2
	PO 12	Recognize the need for advanced concepts for developing applications through continuing education efforts with ongoing learning – stays up with industry trends/ new technology and continued personal development in the broadest context of technological change.	4
	PSO 1	Develop MIMD architecture for optimizing the performance related to Algorithms, Software and Networking.	1
	PSO 3	Recognize importance of pipelining, inter process communication of advanced micro processors for creating innovative career paths, to be an entrepreneur and desire for higher studies.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	4	-	-	-	-	-	-	-	-	-	1	1	-
CO 2	2	-	-	-	-	-	-	-	-	-	-	-	1	2	-
CO 3	2	2	1	3	-	-	-	-	-	2	-	2	1	-	-
CO 4	3	6	-	4	-	-	-	-	-	2	-	3	1	-	-
CO 5	1	2	3	3	-	-	-	-	-	2	-	4	1	-	1
CO 6	2	-	-	-	-	-	-	-	-	2	-	4	1	-	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	33.4	20	40	-	-	-	-	-	-	-	-	-	16.6	50	-
CO 2	66.6	-	-	-	-	-	-	-	-	-	-	-	16.6	100	-
CO 3	66.6	20	10	27.3	-	-	-	-	-	20	-	16.6	16.6	-	-
CO 4	100.0	60	-	36.4	-	-	-	-	-	20	-	25	16.6	-	-
CO 5	33.4	20	30	27.3	-	-	-	-	-	20	-	33.4	16.6	-	50
CO 6	66.6	-	-	-	-	-	-	-	-	20	-	33.4	66.7	-	50

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, **0** being **no correlation**, **1** being the **low correlation**, **2** being **medium correlation** and **3** being **high correlation**.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\ \% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	2	-	-	-	-	-	-	-	-		1	-	3
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	1	-	3
CO 3	3	1	1	1	-	-	-	-	-	1	-	1	1	-	-
CO 4	3	3	-	1	-	-	-	-	-	1	-	1	3	-	-
CO 5	1	1	1	1	-	-	-	-	-	1	-	1	1	-	3
CO 6	3	-	-	-	-	-	-	-	-	1	-	1	1	-	3
TOTAL	14	6	4	3	-	-	-	-	-	4	-	4	8	-	12
AVERAGE	2.3	1.5	2.6	1	-	-	-	-	-	1	-	1	1.33	-	3

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Assignments	✓
Seminars	✓	Student Viva	-	Certification	-
Laboratory Practices	-	Student viva	-	Mini projects	-
Term Paper	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO COMPUTER ORGANIZATION**
	Basic computer organization, CPU organization, memory subsystem organization and interfacing, input or output subsystem organization and interfacing, a simple computer levels of programming languages, assembly language instructions, instruction set architecture design, a simple instruction set. .
MODULE II	**ORGANIZATION OF A COMPUTER**
	Register transfer: Register transfer language, register transfer, bus and memory transfers, arithmetic micro operations, logic micro-operations, shift micro-operations; Control unit: Control memory, address sequencing, micro program example, and design of control unit.
MODULE III	**CPU AND COMPUTER ARITHMETIC**
	CPU design: Instruction cycle, data representation, memory reference instructions, input-output, and interrupt, addressing modes, data transfer and manipulation, program control. Computer arithmetic: Addition and subtraction, floating point arithmetic operations, decimal arithmetic unit.
MODULE IV	**INPUT-OUTPUT ORGANIZATION AND MEMORY ORGANIZATION**
	Memory organization: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory; Input or output organization: Input or output Interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access.
MODULE V	**MULTIPROCESSORS**
	Pipeline: Parallel processing, pipelining-arithmetic pipeline, instruction pipeline; Multiprocessors: Characteristics of multiprocessors, inter connection structures, inter processor arbitration, inter processor communication and synchronization.

TEXTBOOKS

1. 1. M. Morris Mano, "Computer Systems Architecture", Pearson, 3 rd Edition, 2015.
2. 2.John D. Carpinelli, "Computer Systems Organization and Architecture", Pearson, 1 st Edition, 2001.
3. 3. Patterson, Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Morgan Kaufmann, 5 th Edition, 2013.

REFERENCE BOOKS:

1. 1. John. P. Hayes, “Computer System Architecture”, McGraw-Hill, 3 rd Edition, 1998.
2. 2. Carl Hamacher, Zvonko G Vranesic, Safwat G Zaky, “Computer Organization”, McGraw-Hill, 5 th Edition, 2002.
3. 3. William Stallings, “Computer Organization and Architecture”, Pearson Edition, 8 th Edition, 2010

WEB REFERENCES:

1. http://www.web.stanford.edu/class/cs103x

COURSE WEB PAGE:

1. https://lms.iare.ac.in/index?route=course/details & course_id=528

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO’s	Reference
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO’s to PO’s PSO’s and their attainments are discussed.		
CONTENT DELIVERY (THEORY)			
1-2	Outline the basic computer organization	CO1	T1: 4.1-4.2,T1: 4.1
2-3	Understand the CPU organization, memory subsystem organization and interfacing	CO 1	T1: 4.3-4.4
4-5	Analyze the input or output subsystem organization and interfacing	CO 1,CO6	T1: 3.1-3.2
5-6	Understand a simple computer levels of programming languages	CO 1	T2: 2.5-2.6,
7-8	Explain assembly language instructions	CO 2, CO 3	T1:1.5, 1.4.2,1.4.3
9	Determine the simple instruction set architecture	CO 2	T2: 7.4
10-11	Understand the register transfer language, register transfer.	CO 2	T2: 5.6-5.7
12	Analyze bus and memory transfers	CO 2	T1: 6.7-6.8
13-15	Explain the arithmetic micro-operations, logic micro-operations, shift micro-operations	CO 2	T2: 8.5-8.7
16	Understand the control memory	CO 5	T2: 8.6
17-18	Explain the instruction cycle	CO 2	T2: 10.1-10.5
19-20	Outline the data representation, memory reference instructions	CO 3	T2: 12.1
20-21	Analyze input-output, and interrupt, addressing modes	CO 3	T2: 11.2

22	Discuss the data transfer and manipulation, program control	CO 3	T2: 11.3-11.4
23-25	Determine the Addition and subtraction, floating point arithmetic operations, decimal arithmetic unit	CO 4	T2: 11.5
26	Need of Input or output organization	CO5	R1: .3.1
27-29	Discuss the Input or output Interface	CO5	R1: 3.3-9.5
30-31	Understand the asynchronous data transfer, modes of transfer	CO5	T2: 9.4
32-33	Analyze the priority interrupt, direct memory access	CO5	T2:13.1
34	Understand the memory organization	CO5	T2:13.2
35-36	Discuss Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory	CO 5	T2: 13.3
37-38	Understand the Pipeline: Parallel processing, Instruction pipeline	CO6	T2: 13.
39	Characteristics of multiprocessors	CO6	T2: 13.1
40	Inter connection structures	CO6	T2: 13.2
41	Inter processor arbitration	CO 3,CO6	T2: 13.3
42	Inter processor communication and synchronization	CO 6	T2: 13.4
PROBLEM SOLVING/ CASE STUDIES			
1	Problems on BCD conversions	CO1	T2:2.1
2	Problems on BCD conversions	CO1	T2:2.3
3	Problems on Addition and substraction	CO3	T2:2.3.1
4	Problems on Multiplication	CO3	T2:7.2,7.3
5	Problems on Booths multiplication	CO3	T2:10.3.1
6	Problems on Booths Algorithm	CO3	T2:13.3.2, 13.4.1
7	Problems on Division	CO3	T2:17.1.1, 17.1.3
8	Problems on Data presentation	CO3	T2:18.3.4, 18.3.4.1
9	Problems on Data presentation	CO3	T2:22.12, 19.1.2
10	Problems on Data presentation	CO3	T2:18.4, 18.4.3
11	Problems on floating point arithmetic operations	CO3	T2:19.2, 18.4.4
12	Problems on Decimal arithmatic unit	CO3	T2:23.1.1, 23.1.3
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Define register transfer language,fixed point number,instruction format,data Processing instruction,data Processing instruction	CO 1	T2:18.3.4, 18.3.4.1
2	Define miscellaneous Instructions, addressing mode,micro operation.	CO 2	T2:22.12, 19.1.2
3	Define arithmetic micro operations,arithmetic micro operations,logical shift operation	CO 3	T2:18.4, 18.4.3

4	Define data bus,metropolitan area network,network topology,star topology,bus tropology	CO4, CO 5	T2:19.2, 18.4.4
5	define vecto,pipeline cycle time, arithmetic pipeline,optimal number of pipeline stages	CO 6	T2:23.1.1, 23.1.3
DISCUSSION ON QUESTION BANK			
1	Illustrate the input and output operations with a neat diagram.	CO 1	T2:18.3.4, 18.3.4.1
2	List the various instruction formats and illustrate with an example.	CO 2	T2:22.12, 19.1.2
3	Identify micro programexample and build a computer hardware configuration	CO3,CO4	T2:18.4, 18.4.3
4	Illustrate the belowaddressing modes withexamples a. Implied Modeb. Immediate Mode c. Autoincrement and Auto,decrement Mode d. Direct and Indirect Address Mode.	CO5	T2:19.2, 18.4.4
5	Define parallel processing and explain the flynn's classification of computer with suitable diagram	CO 6	T2:23.1.1, 23.1.3

Course Coordinator
Dr. P Cahandana, Associate Professor

HOD,CSE (AI & ML)

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Course Title	ADVANCED PYTHON PROGRAMMING LABORATORY				
Course Code	ACSC11				
Program	B.Tech				
Semester	III	CSE			
Course Type	Core				
Regulation	IARE R-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	1	-	-	2	2
Course Coordinator	Dr. K. Suvarchala, Associate Professor,CSE				

I COURSE OVERVIEW:

Advanced Python lab provides hands on experience in implementing different modules and develops competence in choosing appropriate data structure and techniques to improve efficiency of application.This laboratory implements matrices and multi dimensional arrays using multilists, GUI applications with tkinter and image processing modules, database connectivity for handling large data sets,mathematical modules and OOPs concepts. This is essential for developing software in areasArtificial Intelligence, Machine learning Bigdata analytics and many more recent areas.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	ACSC01	I	Programming Programming

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Advanced Python Programming Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

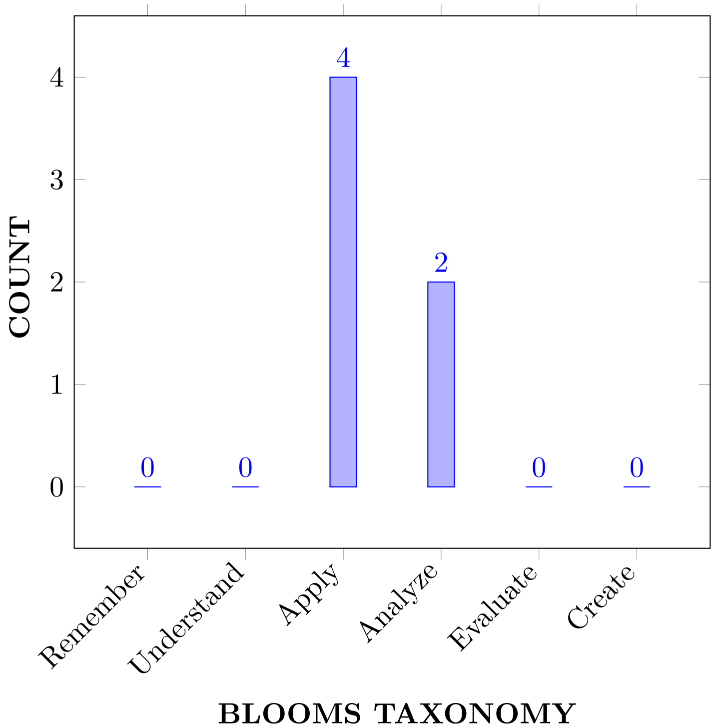
I	The programming skills in advanced Python concepts to develop software using different modules.
II	Applying Object-orientedprogrammingconcepts with exception handlers for realtime engineering problems.
III	Implementation of different database applications using interface with GUI approach

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Apply** complex data structures and advanced packages to organize code in modules.	Apply
CO 2	**Make use of** object oriented concepts, exception handling for un-interrupted execution of real time applications	Apply
CO 3	**Develop** User defined functions for better modularity and high degree of code reusability.	Analyze
CO 4	**Develop** database applications using different file handling techniques and database connectivity .	Apply
CO 5	**Utilize** numpy, date time modules to solve mathematical related problems.	Analyze
CO 6	**Examine** tkinter and turtle modules for developing web based applications.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems..	2	Lab Exercises,CIE,SEE
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercises,CIE,SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3	Lab Exercises,CIE,SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	Lab Exercises,CIE,SEE
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Lab Exercises,CIE,SEE
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Lab Exercises,CIE,SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	2	Lab Exercises

PSO 2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	3	Lab Exercises
PSO 3	**Successful Career and Entrepreneurship:** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry	1	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Apply the knowledge of mathematics, engineeringfundamentals, to solve complex engineering problems with complex data strictures and advanced packages.	2
	PO 2	Make Use of advanced data structures and packages for solving multi-dimensional related problems with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	5
	PO 3	Make Use of complex data types and packages for developing solutions to multidimensional based problems and with the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions	5
	PO 5	Select appropriate complex data type to solve multidimensional related problems using recent python compiler.	1
	PO 10	Build strong foundation on advanced packages of pythonfor career building by communicating effectively with engineering community about optimal solutions.	2
	PSO 1	Demonstrate algorithmic strategies systematically to get solution into by using its Libraries and modules of Python	1
CO 2	PO 2	Demonstrate object oriented concepts and exception handlers for implementing real time applications with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	4
	PO 3	Build applications using class and object concepts with the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions	5

	PO 5	Make Use ofexception handlers for identifying errors in programming problems by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.	1
	PO 10	Build strong foundation on object orientation paradigm for career building by communicating effectively with engineering community about optimal solutions.	4
	PO12	Model applications with classes and objects for career building in object oriented software development .	2
	PSO 3	Applypython advanced object oriented concepts for further study in upcoming technologies such as Machine learning and data science.	1
CO 3	PO 3	Make Use of functions for developing large applications with the problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	5
	PO 3	Apply code reusability techniques with the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions	4
	PO 5	Demonstrate user defined functions for implementing modular programming in designing new software	1
	PO 10	Build strong foundation on Principle of Optimality for career building by communicating effectively with engineering community about optimal solutions.	3
	PO12	Utilize code reusability on complex applications for career building in software development.	2
	PSO1	Relate algorithmic strategies systematically to get solution to problems by using User defined function and code reusability.	2
	PSO 3	Model real time applications in python by using code reusability concepts for higher studies and career development.	2
CO 4	PO 2	Apply data and file handling techniques for database applications with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	5
	PO 3	Model database projects by Investigating needs, defining the problem, identifying constraints, Manage the design process, evaluate outcomes for obtaining innovative solutions	5
	PO 5	Utilize database connectivity to develop computer software and packages.	1
	PO 10	Build strong foundation on database connectivity techniques for developing database application with clarity.	2

	PO 12	Construct data and filebased applications using current CSE concepts with project management skills for obtaining advanced degree as a part of continuing education	4
	PSO2	Design database applications using database connectivity to design information retrieval systems	1
	PSO 3	Apply python file and database handling techniques for building career in advanced computer technologies	1
CO 5	PO 1	Make use of numpy, date and time modules for developing mathematical and statistical based solutions with the help of mathematics and engineering fundamentals	2
	PO 2	Utilize numpy, date and time modules for developing large applications with the problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	5
	PO 3	Apply numpy, date and time modulesutilities to complex problemswith the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions	5
	PO 5	Demonstrate numpy, date and time modules for implementing mathematical time related programming in designing new software	1
	PO10	Build strong foundation on various modules for career building by communicating effectively with engineering community about optimal solutions.	2
	PSO3	Utilize numpy, data and time modulesin implementing future applications of advanced computer technologies	1
CO 6	PO 1	Demonstrate web based applications by applyting the knowledge of mathematics, engineering fundamentals	2
	PO 2	Illustrate Image and GUI based concepts of advanced python for implementing real time applications with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	4
	PO 3	Develop applications using tkinter and turtle packages by investigating needs of user, defining problem with constraints, design the process for innovating solutions.	4
	PO 5	Make Use of image and GUI based packages to simulate computer basedpackages.	1
	PO10	Build strong foundation on object orientation paradigm for career building by communicating effectively with engineering community about optimal solutions.	2
	PO12	Model applications using turtle and tkinter for career building in web based applicationand implementing related research projects as part of continuing education.	3
	PSO3	Apply python advanced packages turtle and tkinter in future technologies , projects and research	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Course Outcomes	Program Outcomes						Program Specific Outcomes		
	PO1	PO2	PO3	PO5	PO10	PO12	PSO1	PSO2	PSO3
CO1	2	5	5	1	2	1	-	-	-
CO2	-	4	5	1	4	2	-	-	-
CO3	-	5	4	1	3	2	-	2	2
CO4	-	5	5	1	2	4	-	1	1
CO5	2	5	5	1	2	-	-	-	1
CO6	2	4	4	1	2	3	-	-	1

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams ✓	Seminars	-	
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**DICTIONARY**
	a. Write a program to count the numbers of characters in the string and store them in a dictionary data structure b. Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure. c. Write a program combine_lists that combines these lists into a dictionary. d. Write a Python program to find shortest list of values with the keys in a given dictionary
WEEK II	**NESTED LISTS**
	a. Write a program to read a 3 X 3 matrix and find the transpose. b. Write a program to perform addition, subtraction of two 3 X 3 matrices. c. Write a program to perform multiplication of two 3 X 3 matrices. d. Write a program to check whether two given 3 X 3 matrices are identical or not.
WEEK III	**USER DEFINED FUNCTIONS**

	a. Write a function bal_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding. Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius If (distance between two balls centers)<= (sum of their radii) then (they are colliding) b. Write a function to find mean, median, mode for the given set of numbers in a list. c. Write a function nearly_equal to test whether two strings are nearly equal. Two strings a and bare nearly equal when a can be generated by a single mutation on b.(HINT:- Nearly equal string : Python - Jython, Perl - Pearl) d. The mathematician Srinivasa Ramanujan found an infinite series that can be used to generate a numerical approximation of 1/ re : Write a function called estimate_pi that uses this formula to compute and return an estimate ofrc. It should use awhile loop to compute terms of the summation until the last term is smaller than le-15 (which is Python notation for 10-15) You can check the result by comparing it to math.pi.
WEEK IV	**MODULES**
	a. Installpackagesrequests,flaskandexploreusing(pip) b. WriteaPythonprogramthatimportsrequestsandfetch contentfromwikipage. c. WriteaPython programtogenerateaseriesofuniquerandomnumbersbyusingrandommodule d. WriteaPythonprogramtofindthesubstringswithinastringusingremodule.
WEEK V	**DATE AND TIME**
	a. Demonstrate Basic date and time classes, Different time formats, Converting between fonnats, Formatting dates and times, Parsing date/time in formation. b. Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch. c. Design a Python script to determine the difference in date forgiven two dates in YYYY:MM:DD format(0<=YYYY<=9999,1<=MM <=12,1<=DD<=31)following the leap year rules. d. DesignaPythonScripttodeterminethetimedifferencebetweentwogiven-timesinHH:MM:SS format.(0 <=HH<=23,0<=MM<=59,0<=SS<=59).

WEEK VI	**CLASS AND OBJECTS**
	a.Create a class ATM and define ATM operations to create account, deposit, check_balance, withdraw and delete account.Use constructor to initialize members. b. Make a class Employee with a name and salary. Make a class Manager inherit from Employee. Add an instancevariable ,named department.Write a method that prints manager's name, department and salary.Make a classExecutive inherit from Manager.Write a method that prints the string "Executive" followed by the informationstoredintheManagersuperclassobject. c. A hospital wants to create a database regarding its in door patients. The information to store include a) Name ofthe patient b) Date of admission c) Disease d) Date of discharge. Create a structure to store the date (year,month and date as its members). Create a base class to store the above information. The member functionshould include functions to enter information and display a list of all the patients in the database. Create aderived class to store the age of thepatients. List the information about to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).
WEEK VII	**FILE HANDLING**
	a. Write a python program to read the file contents and do the following operations i) Print each word of a file in reverse order. ii) Print each line of a file in reverse order.Sample Input: Python Programming Sample Output: Programming Python iii) Display the content of a without white spaces. b. Demonstrate Serializing Data with XML and JSON: i) Working with XML modules in Python ii) Start with Element Tree iii) Parsing XML iv) Updating an XML tree v) Creating a new document vi) YAML, other formats as time permits vii) Reading,Writing JSON viii) Reading/writing CSV file S c. Write a Python program to store N student's records containing name, roll number and branch. Print the given branch student's details only.
WEEK VIII	**EXCEPTION HANDLING**
	a. Read two numbers nl and n2.Write a function to compute nl/n2 and use try/except to catch the exceptions. b. Write a Python program to detect and handle the exception while solving the quadratic equation. c. Write a Python program to handle the run time errors while doing file handling operation. d. Write a Python program to create and raise user defined exception.

WEEK IX	**MULTI THREADING AND TESTING**
	a. Write a python program to create two threads to keep a count of number of even numbers entered by the user. b. Write a JAVA program that creates threads by extending Thread class .First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds. c. Write a test-case to check the function even_numbers which return True on passing a list of all even numbers. d. Write a test-case to check the function reverse_string which returns the reversed string.
WEEK X	**NUMPY**
	a. Using Numpy, write a basic array of operations on single array to add x to each element of array and subtract y from each element of array. b. Using Numpy, write a program to add, subtract and multiply two matrices. c. Write a Python program to do the following operations: Library: NumPy i) Create multi-dimensional arrays and find its shape and dimension ii) Create a matrix full of zeros and ones iii) Reshape and flatten data in the array iv) Append data vertically and horizontally v) Apply indexing and slicing on array vi) Use statistical functions on array - Min, Max, Mean, Median and Standard Deviation vii)Dot and matrix product of two arrays viii) Compute the Eigen values of a matrix ix) Solve a linear matrix equation such as $3 * x0 + x1 = 9$, $x0 + 2 * x1 = 8$ x) Compute the multiplicative inverse of a matrix xi) Compute the rank of a matrix xii)Compute the determinant of an array
WEEK XI	**GUI**
	e. Design a GUI based calculator to perform arithmetic operations like addition, subtraction, multiplication and division. (Hint: Expression Calculator using tk) f. Design a GUI based application to convert temperature from Celsius to Fahrenheit. g. Write a python program to perform various database operations (create, insert, delete, update).
WEEK XII	**GRAPHICS**
	a. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Use object oriented approach b. Design a Python program using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed. c. Write a python program to implement the following figures using turtle

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1. Michael H Goldwasser, David Letscher, "Object Oriented Programming in Python", Prentice Hall, 1st Edition, 2007.
2. Yashavant Kanetkar, Aditya Kanetkar, "Let us Python, BPB publication, 1st Edition, 2019.
3. Ashok Kamthane, Amit Kamthane, "Programming and Problem solving with Python", McGraw Hill Education (India) Private Limited, 2018.
4. Taneja Sheetal, Kumar Naveen, "Python Programming – A Modular Approach", Pearson, 2017
5. R Nageswara Rao, "Core Python Programming", Dreamtech Press, 2017 Edition.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Dictionary	CO1	T1
2	Nested Lists	CO1	T1
3	User defined Functions	CO3	T2
4	Modules	CO3	T4
5	Date and Time	CO5	T4
6	Class and Object	CO2	T3
7	File Handling	CO4	T3
8	Exception Handling	CO2	T5
9	Multi Threading and Testing	CO4	T5
10	NUMPY	CO5	T4
11	GUI	CO6	T5
12	Graphics	CO6	T5

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Implementation of Machine learning algorithms.
2	Developing an operating system.
3	Creation of Multiplayer game

Signature of Course Coordinator **HOD,CSE**
Dr. K. Suvarchala, Associate Professor,CSE

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

<table>
<tr><td>Course Title</td><td colspan="5">Programming with Objects Laboratory</td></tr>
<tr><td>Course Code</td><td colspan="5">AITC03</td></tr>
<tr><td>Program</td><td colspan="5">B.Tech</td></tr>
<tr><td>Semester</td><td>III</td><td colspan="4">CSE</td></tr>
<tr><td>Course Type</td><td>CORE</td><td colspan="4"></td></tr>
<tr><td>Regulation</td><td>UG20</td><td colspan="4"></td></tr>
<tr><td rowspan="3">Course Structure</td><td colspan="3">Theory</td><td colspan="2">Practical</td></tr>
<tr><td>Lecture</td><td>Tutorials</td><td>Credits</td><td>Laboratory</td><td>Credits</td></tr>
<tr><td>0</td><td>0</td><td>-</td><td>3</td><td>1.5</td></tr>
<tr><td>Course Coordinator</td><td colspan="5">Mr.N.V.Krishna Rao, Assistant Professor</td></tr>
</table>

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC01	II	Programming for Problem Solving
B.Tech	ACSC08	III	Data Structure

II COURSE OVERVIEW:

Thiscoursepresentstheprinciplesofobjectorientedprogrammingusingthe Javalanguage, one of the most increasingly preferred languages for programming today. The knowledge gained in this course can be applied later to other languages such as python, C++. This course uses Net beans IDE to afford a more interactive experience. This course helps to develop different applications in various domains like GUI Applications, BigData, Web-based Applications, etc..

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Object Oriented Programming Through Java	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	Problem-solving strategy to break down a complex problem in to a series of simpler tasks..
II	The semantics of exception handling in Java, and use it to write reliable Java code.

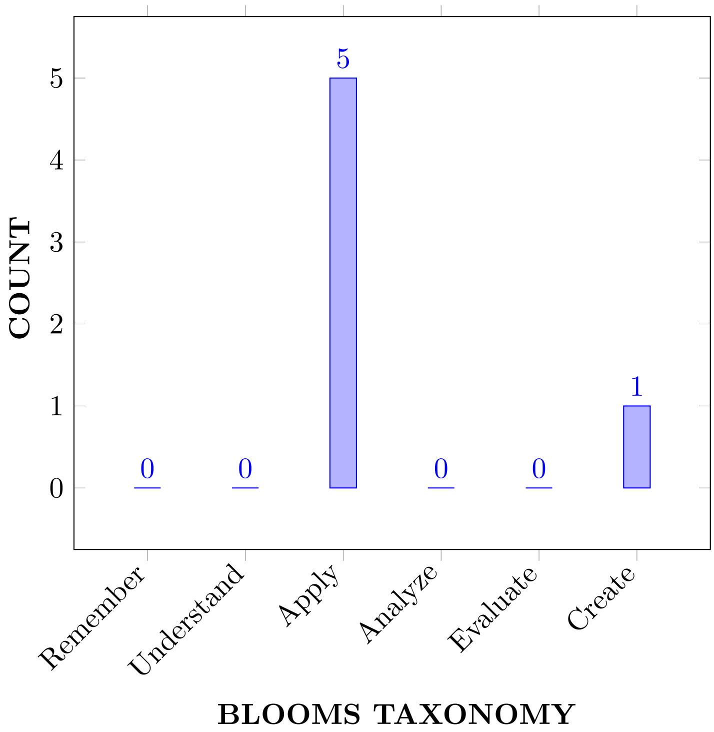
III	The event-driven programming principles by developing programs using graphical user interface.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Make use of** operators, precedence of operators, associatively while evaluating expressionsin program statements. .	Apply
CO 2	**Make use of** the concept of class and objects with access control and polymorphism techniques to represent real worldentities.	Apply
CO 3	**Demonstrate** design principles fincluding information hiding, encapsulation and exceptional handling .	Apply
CO 4	**Implement** the concepts of Multi-threading and files in soft real time systems.	Apply
CO 5	**Apply** the concepts of abstract class and inheritance for code reusability and extensibility.	Apply
CO 6	**Design** event-driven programming principles for developing programs using graphical user interface..	Create

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Lab Exercise, CIE,SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complexengineering-problemsreachingsubstantiatedconclusionsusingfirst principles of mathematics, natural sciences ,and engineering sciences.	2	Lab Exercise, CIE,SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	Lab Exercise, CIE,SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	1	Lab Exercise, CIE,SEE
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Lab Exercise, CIE,SEE
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	3	Lab Exercise, CIE,SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Problem-Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success	3	Lab Exercises
PSO 2	Focus on improving software reliability, network security or information retrieval systems	3	Lab Exercises

PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	**Justification for mapping (Students will be able to)**	No. of Key Competencies
CO 1	PO 1	Make use of Usage of object oriented programming fundamentals **using principles of mathematics, science, and engineering fundamentals.**	3
	PO 2	Make use of Usage of object oriented programming fundamentals **with Problem statement and system definition, Problem formulation.**	2
	PO 5	Understanding **of the limitations of Modern Tool Usage.**	3
	PO 10	Build strong foundation of programming Schemes for career building by communicating **effectively with engineering community.**	2
	PO 12	Build strong foundation of programming schemes for career **building by communicating effectively with engineering concepts.**	2
	PSO 2	Focus on improving software reliability, **network security or information retrieval systems..**	2
	PSO 3	Describe the well utilization of r **resources for the better performance of the system.**	2
CO 2	PO 1	Describe to use indexing mechanisms for extracting a portion of data in a sequence**using principles of mathematics ,and engineering fundamentals..**	2
	PO 5	Understanding **of the limitations of Modern Tool Usage.**	3
	PO 10	Build strong foundation of programming Schemes for career building by communicating **effectively with engineering community.**	3
	PO 12	Build strong foundation of programming schemes for career **building by communicating effectively with engineering concepts.**	3
	PSO 1	Under stand the concepts of polymorphism techniques , **and apply real world entity.**	2
	PSO 2	Demonstrate on writing programs using object and classes concepts for applications such as computational geometry, Big data **by understanding and applying the engineering principles..**	2
	PSO 3	Describe the well utilization of r **resources for the better performance of the system.**	2

CO 3	PO 1	Demonstrate on information hiding encapsulation with regard to how they will be implemented using the **using fundamentals of mathematics ,science, and engineering.**	2
	PO 5	Understanding **of the limitations of Modern Tool Usage.**	3
	PO 10	Build strong foundation of programming Schemes for career building by communicating **effectively with engineering community.**	3
	PO 12	Build strong foundation of programming schemes for career **building by communicating effectively with engineering concepts.**	3
	PSO 2	Make use of exceptional handling to design and develop **efficient real-time computational problems.**	3
CO 4	PO 1	Describe the use of multi threading problem solving **using the knowledge of mathematics, science, and engineering fundamentals.**	3
	PO 3	Usage of Demonstrate the importance of file structures for developing programs in real-time scenarios **by communicating effectively with engineering community.**	2
	PO 5	Understanding **of the limitations of Modern Tool Usage.**	3
	PO 10	Build strong foundation of programming Schemes for career building by communicating **effectively with engineering community.**	3
	PO 12	Build strong foundation of programming schemes for career **building by communicating effectively with engineering concepts.**	3
	PSO 1	Understand the concepts of multithread, elements of **parallel program execution and importance of CPU utilization.**	2
	PSO 3	Describe the well utilization of r **resources for the better performance of the system.**	2
CO 5	PO 1	Describe the importance of abstract class and inheritance **by understanding and applying the fundamentals of mathematics, science and engineering.**	3
	PO 3	Usage of Build strong foundation of writing efficient modular programs using parameter passing mechanisms for career building. **By communicating effectively with engineering community.**	2
	PO 5	Understanding **of the limitations of Modern Tool Usage.**	3
	PO 10	Build strong foundation of programming Schemes for career building by communicating **effectively with engineering community.**	3

	PO 12	Build strong foundation of programming schemes for career **building by communicating effectively with engineering concepts.**	3
	PSO 2	Understand he concepts of abstract class and inheritance **for code reusability and extensibility.**	3
CO 6	PO 1	Make use of appropriate modules/packages in Java while developing solutions **using the knowledge of mathematics, science, and engineering fundamentals.**	3
	PO 3	Usage of Demonstrate the usage of modules/packages in designing and developing . **solutions of complex engineering applications..**	2
	PO 5	Understanding **of the limitations of Modern Tool Usage.**	3
	PO 10	Build strong foundation of programming Schemes for career building by communicating **effectively with engineering community.**	3
	PO 12	Build strong foundation of programming schemes for career **building by communicating effectively with engineering concepts.**	3
	PSO 1	Understand the concepts event-driven programming principles for **developing programs using graphical user interface.**	2
	PSO 2	Usage of Make use of modern computer tools and appropriate modules in building **real-time applications for a successful career.**	3
	PSO 3	Describe the well utilization of **resources for the better performance of the system.**	2

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

Course Outcomes	Program Outcomes						Program Specific Outcomes		
	PO1	PO2	PO3	PO5	PO10	PO12	PSO1	PSO2	PSO3
CO1	1	2		3	2	1	-	2	2
CO2	2			3	3	2	2	2	2
CO3	2			3	3	2	-	2	
CO4	1		2	3	2	4	3		2
CO5	1		2	3	3	-	-	3	
CO6	2	2		3	3	3	2	3	2

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**BASICPROGRAMS**
	1.Try debug step by step with small program of about 10 to 15 lines which contains at least one if else condition and a for loop. 2. Write a java program that prints all real solutions to the quadratic equation ax2 +bx+c=0. Read in a, b, c and use the quadratic formula. 3. The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a java program that uses both recursive and non-recursive functions .
WEEK II	**MATRICES, OVERLOADING, OVERRIDING**
	1. Write a java program to multiply two given matrices. 2. Write a java program to implement method overloading and constructors overloading. 3. Write a java program to implement method overriding
WEEK III	**PALINDROME, ABSTRACT CLASS**
	1. Write a java program to check whether a given string is palindrome. 2. Write a java program for sorting a given list of names in ascending order. 3. Write a java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape. .
WEEK IV	**INTERFACE**
	Write a program that creates a user interface to perform integer division. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 and Num2 were not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

WEEK V	**MULTITHREADING**
	1. Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. 2. Write a java program that correct implements of producer consumer program.
WEEK VI	**FILES**
	1. Write a java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes. 2. Write a java program that displays the number of characters, lines and words in a text file. 3. Write a java program that reads a file and displays the file on the screen with line number before each line
WEEK VII	**FILES**
	1. Suppose that table named table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using labels in grid layout. 2. Write a java program that connects to a database using JDBC and does add, delete, modify and retrieve operations.
WEEK VIII	**JAVA PROGRAM WITH DATABASE**
	1. Write a java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (/t). It takes a name or phone number as input and prints the corresponding other value from the hash table. Hint: Use hash tables. 2. Implement the above program with database instead of a text file.
WEEK IX	**FILES**
	1. Write a java program that takes tab separated data (one record per line) from a text file and insert them into a database. 2. Write a java program that prints the metadata of a given table.
WEEK X	**TRAFFIC LIGHT**
	1. Write a java program that simulates a traffic light. The program lets the user select one of three lights: Red, Yellow or Green with radio buttons. On selecting a button an appropriate message with —STOP‖ or —READY‖ or ‖GO‖ should appear above the buttons in selected color. Initially, there is no message shown.
WEEK XI	**MOUSE EVENTS**
	1. Write a java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. Use adapter classes. 2. Write a java program to demonstrate the key event handlers.
WEEK XII	**CALCULATOR**
	Write a java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +,-,*, operations. Add a text field to display the result. Handle any possible exception like divided by zero.

WEEK XIII	**APPLET**
	1. Develop an applet that displays a simple message. 2. Develop an applet that receives an integer in one text field and computes its factorial value and returns it in another text field, when the button named —compute‖ is clicked.

TEXTBOOKS

1. HerbertSchildt and DaleSkrien,“JavaFundamentals– A comprehensive Introduction ” , McGrawHill, 1stEdition,2013.

2. HerbertSchildt, “Java the Complete Reference”, McGraw Hill, Osborne, 7thEdition, 2011

REFERENCE BOOKS:

1. P. J. Deitel, H. M. Deitel, —Java for Programmers‖, Pearson Education, PHI, 4 th Edition, 2007.

2. P. Radha Krishna, —Object Oriented Programming through Java‖, Universities Press, 2 nd Edition, 2007.

3. Bruce Eckel, —Thinking in Java‖, Pearson Education, 4 th Edition, 2006. 4. Sachin Malhotra, Saurabh Chaudhary, —Programming in Java‖, Oxford University Press, 5 th Edition, 2010

WEBREFERENCES:

1. www.niecdelhi.ac.in .

2. https://www.linkedin.com/in/achin-jain-85061412

3. www.rank1infotech.com

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Operators and Expressions..	CO 1	T2:4.1– 4.8
2	Selection/ConditionalBranchingStatements:if,if-else,nestedif,if-elseif-elsestatement.	CO 1,CO 2	T2:2.1– 2.9
3	Abstract class and interface mplementation.	CO 4	T2:2.1–2.9 T2:10.2
4	Polymorphism and inheritance implementation.	CO 3,CO 5	T2:8.1– 8.7
5	Multithreading programming In java..	CO 4	T2:11.1–11.6
6	File's handling using java programming.	CO 3,CO 4	T2:13.5–13.6
7	Database connectivity using java programming.	CO 2,CO 6	T2:24.1–24.6
8	Event handling and abstract window.	CO 2,CO 6	T2:24.1–24.6
9	Event handling and layouts.	CO 2, CO 6	T2:24.1–24.6 T2:21.61
10	Applets.	CO 2, CO 6	T2:25.4–25.6

11	Loop Structures/Iterative Statements– While and for loop, Nested loops. .	CO 2,CO 6	T2:5.1– 5.3 T:21.29
12	Classes and Objects–Defining Classes, Creating Objects.	CO 2	T2:6.1– 6.5

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	You are the owner of a big company. You are so rich, that the government has allowed you to print as many notes as you want of any single value that you like. You also have peculiar behavior altra its and you often do things that look weird to a third person. You have N N employees, where the employee has salary Ai Ai. You want to pay them using a denomination that you create. You are also eco friendly and wish to save paper. So, you wish to pay them using as few notes as possible. Find out the minimum number of notes required if you can alter the salary of at most one employee to any positive integer that you like, and choose the positive integer value that each note is worth (called its denomination). Each employee must receive the exact value of his/her salary and no more.
2	You're given a tree with N vertices numbered from 1 to N Your go a list of handle queries. For each query you are given K nodes v1,v2,...,vK. Find if there exists a simple path in the tree covering the give n vertices.

Signature of Course Coordinator **HOD,CSE**
Mr.N.V.Krishna Rao Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCINECE AND ENGINEERING

COURSE DESCRIPTION

Course Title	**DATA STRUCTURES LABORATORY**					
Course Code	ACSC10					
Program	B.Tech					
Semester	III	CSE				
Course Type	Core					
Regulation	IARE - UG 20					
Course Structure	Theory			Practical		
	Lecture	Tutorials	Credits	Laboratory	Credits	
	-	-	-	3	1.5	
Course Coordinator	Mrs. K LAXMINARAYANAMMA,Assistant Professor,IT					

I COURSE OVERVIEW:

The course covers some of the general-purpose data structures and algorithms, and software development. Topics covered include managing complexity, analysis, static data structures, dynamic data structures and hashing mechanisms. The main objective of the course is to teach the students how to select and design data structures and algorithms that are appropriate for problems that they might encounter in real life. This course reaches to student by power point presentations, lecture notes, and lab which involve the problem solving in mathematical and engineering areas

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC02	I	Python Programming Laboratory
B.Tech	ACSC08	III	Data Structures

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Data Structures Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	To provide students with skills needed to understand and analyze performance trade-offs of different algorithms / implementations and asymptotic analysis of their running time and memory usage.

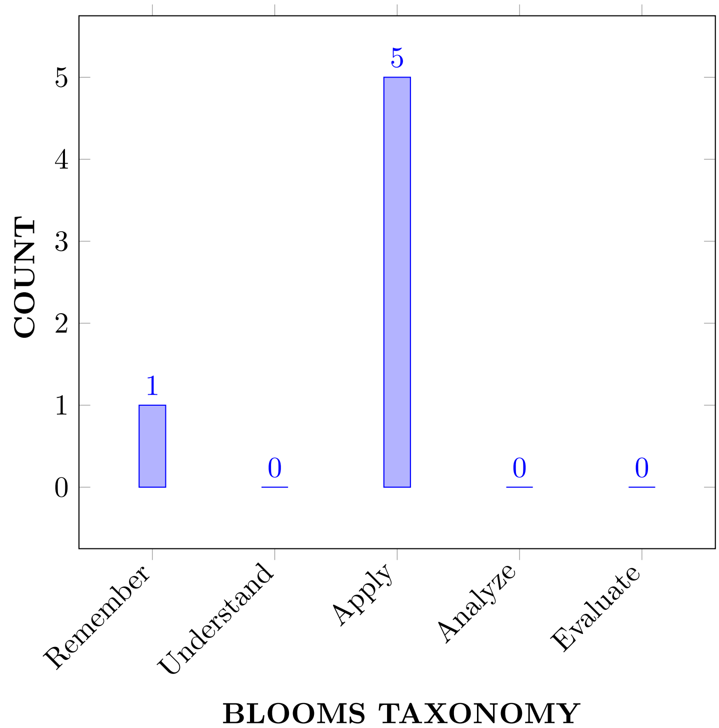
II	To provide knowledge of basic abstract data types (ADT) and associated algorithms: stacks, queues, lists, tree, graphs, hashing and sorting, selection and searching. .
III	The fundamentals of how to store, retrieve, and process data efficiently.
IV	To provide practice by specifying and implementing these data structures and algorithms in Python.
V	Understand essential for future programming and software engineering courses.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** appropriate searching technique for efficient retrieval of data stored location. .	Apply
CO 2	**choose** sorting technique to represent data in specified format to to optimize data searching.	Apply
CO 3	**Make use of** stacks and queues representation, operations and their applications to organize specified data	Understand
CO 4	**utilize** linked lists to implement and perform operations for for organizing specified data	Apply
CO 5	**Construct** tree to perform different traversal techniques	Apply
CO 6	**Select** Appropriate graph traversal techniques to visit the vertices of a graph	Remember

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Lab Exercises
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyse complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences	3	Lab Exercises
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	Lab Exercises
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions	2	Lab Exercises
PO 5	**Modern Tool Usage:**Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	1	Lab Exercises
PO 6	**The Engineer and Society** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice	2	Lab Exercises
PO 8	**Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice	3	Lab Exercises
PO 9	**Individual and Teamwork** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	3	Lab Exercises
PO 10	**Communication:** Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	4	Lab Exercises

PO 12	**Life - Long Learning:**Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		**Strength**	**Proficiency Assessed by**
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	2	Lab Exercises
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	2	Lab Exercises
PSO 3	PMake use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies	2	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	**Justification for mapping (Students will be able to)**	No. of Key Competencies
CO 1	PO 1	Identify appropriate searching technique for efficient retrieval of data stored location by applying the **principles of Mathematics and Engineering** , **Scientific principles and methodology**,**engineering disciplines to integrate / support study**	3
	PO 2	Identify appropriate searching technique for efficient retrieval of data stored location by applying Problem Analysis **Problem statement and system definition**,**Information and data collection**,**Solution development or experimentation / Implementation**	3
	PO 3	**Identify** appropriate searching technique for efficient retrieval of data stored location by applying **Design/Development of Solutions**	3
	PO 4	Identify**apply**appropriate searching technique for efficient retrieval of data stored location by applying **Conduct Investigations of Complex Problems**	2
	PO 5	Identify**apply**appropriate searching technique for efficient retrieval of data stored location by applying Computer software / simulation packages / diagnostic equipment / technical library resources / literature search toolsl	1

	PO 6	Identify**apply**appropriate searching technique for efficient retrieval of data stored location by applying **reasoning informed by the contextual knowledge**	2
	PO 8	Identify**apply**appropriate searching technique for efficient retrieval of data stored location by applying **ethical principles** and commit to professional **ethics and responsibilities** and norms of the Engineering practice	3
	PO 9	Identify**apply**appropriate searching technique for efficient retrieval of data stored location by applying Function **effectively** as an individual, and as a member or leader to get Ability to work with all levels of people in an organization	3
	PO 10	Identify**apply**appropriate searching technique for efficient retrieval of data stored location by **Communicate effectively** on **complex Engineering activities**	3
	PO 12	Identify**apply**appropriate searching technique for efficient retrieval of data stored location by **Keeping current in CSE and advanced engineering concepts**	3
	PSO 1	Identify appropriate searching technique for efficient retrieval of data stored location in **search engines**	2
	PSO 2	Identify appropriate searching technique for efficient retrieval of data stored location in **mobile and web applications development**	2
	PSO 3	Identify appropriate searching technique for efficient retrieval of data stored location **in shipping real world software, using industry standard tools**	3
CO 2	PO 1	choose sorting technique to represent data in specified format to optimize data searching by applying the **principles of Mathematics and Engineering** , **Scientific principles and methodology**,**engineering disciplines to integrate / support study**	3
	PO 2	choose sorting technique to represent data in specified format to optimize data searching by applying Problem Analysis **Problem statement and system definition**,**Information and data collection**,**Solution development or experimentation / Implementation**	3
	PO 3	**Identify** choose sorting technique to represent data in specified format to optimize data searching by applying **Design/Development of Solutions**	3
	PO 4	**choose** sorting technique to represent data in specified format to optimize data searching by applying **Conduct Investigations of Complex Problems**	2
	PO 5	choose sorting technique to represent data in specified format to optimize data searching by applying Computer software / simulation packages / diagnostic equipment / technical library resources / **literature search toolsl**	1
	PO 6	choose sorting technique to **represent** data in specified format to optimize data searching by applying **reasoning informed by the contextual knowledge**	2

	PO 8	**choose** sorting technique to represent data in specified format to optimize data searching by applying **ethical principles** and commit to professional **ethics and responsibilities** and norms of the Engineering practice	3
	PO 9	choose sorting technique to **represent** data in specified format to optimize data searching by applying Function **effectively** as an individual, and as a member or leader to get Ability to work with all levels of people in an organization	3
	PO 10	choose**Apply** sorting technique to represent data in specified format to optimize data searching by **Communicate effectively** on **complex Engineering activities**	3
	PO 12	**choose** sorting technique to **represent** data in specified format to optimize data searching by **Keeping current in CSE and advanced engineering concepts**	3
	PSO 1	choose**Apply** sorting technique to represent data in specified format to optimize data searching in **search engines**	2
	PSO 2	choose**Apply** sorting technique to represent data in specified format to optimize data searching in **mobile and web applications development**	2
	PSO 3	choose**Apply** sorting technique to represent data in specified format to optimize data searching **in shipping real world software, using industry standard tools**	3
CO 3	PO 1	Make use of stacks and queues representation, operations and their applications to organize specified data by applying the **principles of Mathematics and Engineering** , **Scientific principles and methodology**,**engineering disciplines to integrate / support study**	3
	PO 2	Make use of stacks and queues representation, operations and their applications to organize specified data by applying Problem Analysis **Problem statement and system definition**,**Information and data collection**,**Solution development or experimentation / Implementation**	3
	PO 3	**Identify**, **Make use of** stacks and queues representation, operations and their applications to organize specified data by applying **Design/Development of Solutions**	3
	PO 4	Make use of **Apply**stacks and queues representation, operations and their applications to organize specified data by applying **Conduct Investigations of Complex Problems**	2
	PO 5	Make use of stacks and queues representation, operations and their applications to organize specified data by applying Computer software / simulation packages / diagnostic equipment / technical library resources / **literature search tools**	1

	PO 6	**Make use of** stacks and queues representation, operations and their applications to organize specified data by applying **reasoning informed by the contextual knowledge**	2
	PO 8	Make use of stacks and queues **representation**, operations and their applications to organize specified data by applying **ethical principles** and commit to professional **ethics and responsibilities** and norms of the Engineering practice	3
	PO 9	**Make use of** stacks and queues representation, operations and their applications to organize specified data by applying Function **effectively** as an individual, and as a member or leader to get Ability to work with all levels of people in an organization	3
	PO 10	Make use of stacks and queues representation, **operations and their applications** to organize specified data by **Communicate effectively** on **complex Engineering activities**	3
	PO 12	Make use of stacks and queues **representation**, operations and their applications to organize specified data by **Keeping current in CSE and advanced engineering concepts**	3
	PSO 1	Make use of stacks and queues **representation**, operations and their applications to organize specified data in **search engines**	2
	PSO 2	Make use of stacks and queues **representation**, operations and their applications to organize specified data **mobile and web applications development**	2
	PSO 3	Make use of stacks and queues **representation**, operations and their applications to organize specified data **in shipping real world software, using industry standard tools**	2
CO 4	PO 1	utilize linked lists to implement and perform operations for organizing specified data by applying the **principles of Mathematics and Engineering** , **Scientific principles and methodology**,**engineering disciplines to integrate / support study**	3
	PO 2	utilize linked lists to implement and perform operations for organizing specified data by applying Problem Analysis **Problem statement and system definition**,**Information and data collection**,**Solution development or experimentation / Implementation**	3
	PO 3	utilize**Apply** linked lists to **implement** and perform operations for organizing specified data by applying **Design/Development of Solutions**	3
	PO 4	utilize linked lists to **implement** and perform operations for organizing specified data by applying **Conduct Investigations of Complex Problems**	2

	PO 5	utilize linked lists to implement and perform operations for organizing specified data by applying Computer software / simulation packages / diagnostic equipment / technical library resources / **literature search toolsl**	1
	PO 6	utilize linked lists to implement and perform operations for organizing specified data by applying **reasoning informed by the contextual knowledge**	2
	PO 8	utilize linked lists to **implement** and perform operations for organizing specified data by applying **ethical principles** and commit to professional **ethics and responsibilities** and norms of the Engineering practice	3
	PO 9	utilize **Apply**linked lists to implement and perform operations for organizing specified data by applying Function **effectively** as an individual, and as a member or leader to get Ability to work with all levels of people in an organization	3
	PO 10	utilize linked lists to implement and **perform** operations for organizing specified data by **Communicate effectively** on **complex Engineering activities**	3
	PO 12	utilize**Apply** linked lists to implement and perform operations for organizing specified data by **Keeping current in CSE and advanced engineering concepts**	3
	PSO 1	utilize**Apply** linked lists to implement and perform operations for organizing specified in **search engines**	2
	PSO 2	utilize**Apply** linked lists to implement and perform operations for organizing specified in **mobile and web applications development**	2
	PSO 3	utilize**Apply** linked lists to implement and perform operations for organizing specified **in shipping real world software, using industry standard tools**	2
CO 5	PO 1	Construct tree to perform different traversal techniques by applying the **principles of Mathematics and Engineering** , **Scientific principles and methodology**,**engineering disciplines to integrate / support study**	3
	PO 2	Construct tree to perform different traversal techniques by applying Problem Analysis **Problem statement and system definition**,**Information and data collection**,**Solution development or experimentation / Implementation**	3
	PO 3	Construct**Apply** tree to **perform** different traversal techniques by applying **Design/Development of Solutions**	3
	PO 4	**Construct** tree to perform different traversal techniques by applying **Conduct Investigations of Complex Problems**	2

	PO 5	Construct tree to perform different traversal techniques by applying Computer software / simulation packages / diagnostic equipment / technical library resources / **literature search tools**	1
	PO 6	Construct tree to **perform** different traversal techniquesby applying **reasoning informed by the contextual knowledge**	2
	PO 8	ConstructApply tree to perform different traversal techniques by applying **ethical principles** and commit to professional **ethics and responsibilities** and norms of the Engineering practice	3
	PO 9	Construct tree to perform different traversal techniquesby applying Function **effectively** as an individual, and as a member or leader to get Ability to work with all levels of **people in an organization**	3
	PO 10	Construct tree to **perform** different traversal techniques by **Communicate effectively** on **complex Engineering activities**	3
	PO 12	**Construct** tree to perform different traversal techniques by **Keeping current in CSE and advanced engineering concepts**	3
	PSO 1	Construct tree to **perform** different traversal techniques in **search engines**	2
	PSO 2	Construct tree to **perform** different traversal techniques in **mobile and web applications development**	2
	PSO 3	Construct tree to **perform** different traversal techniques **in shipping real world software, using industry standard tools**	2
CO 6	PO 1	Select Appropriate graph traversal techniques to visit the vertices of a graph by applying the **principles of Mathematics and Engineering** , **Scientific principles and methodology**,**engineering disciplines to integrate / support study**	3
	PO 2	Select Appropriate graph traversal techniques to visit the vertices of a graph by applying Problem Analysis **Problem statement and system definition**,**Information and data collection**,**Solution development or experimentation / Implementation**	3
	PO 3	Select Appropriate graph traversal techniques to visit the vertices of a graph by applying **Design/Development of Solutions**	3
	PO 4	**Select** Appropriate graph traversal techniques to visit the vertices of a graph by applying **Conduct Investigations of Complex Problems**	2
	PO 5	Select Appropriate graph traversal techniques to visit the vertices of a graph by applying Computer software / simulation packages / diagnostic equipment / technical library resources / **literature search tools**	1

	PO 6	**Select** Appropriate graph traversal techniques to visit the vertices of a graph by applying **reasoning informed by the contextual knowledge**	2
	PO 8	**Select** Appropriate graph traversal techniques to visit the vertices of a graph by applying **ethical principles** and commit to professional **ethics and responsibilities** and norms of the Engineering practice	3
	PO 9	**Select** Appropriate graph traversal techniques to visit the vertices of a graph by applying Function **effectively** as an individual, and as a member or leader to get Ability to work with all levels of people in an organization	3
	PO 10	**Select** Appropriate graph traversal techniques to visit the vertices of a graph by **Communicate effectively** on **complex Engineering activities**	3
	PO 12	**Select** Appropriate graph traversal techniques to visit the vertices of a graph by **Keeping current in CSE and advanced engineering concepts**	3
	PSO 1	**Select** Appropriate graph traversal techniques to visit the vertices of a graph in **search engines**	2
	PSO 2	**Select** Appropriate graph traversal techniques to visit the vertices of a graph in **mobile and web applications development**	2
	PSO 3	**Select** Appropriate graph traversal techniques to visit the vertices of a graph **in shipping real world software, using industry standard tools**	2

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE	**Program Outcomes/ No. of Key Competencies Matched**											**PSO'S**		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	2	2	3	1	-	1	2	3	-	2	2	1	1
CO 2	1	2	2	2	3	1	-	2	3	3	-	2	1	1	1
CO 3	1	2	2	1	3	1	-	-	2	3	-	2	2	2	-
CO 4	1	2	1	1	3	1	-	-	2	3	-	2	2	1	1
CO 5	1	1	2	1	3	1	-	2	2	3	-	2	2	1	1
CO 6	1	1	2	1	3	1	-	1	3	3	-	2	2	1	1

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**SEARCHING TECHNIQUES**
	Write Python programs for implementing the following searching techniques. a. Linear search. b. Binary search. c. Fibonacci search.
WEEK II	**SORTING TECHNIQUES**
	Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Bubble sort. b. Insertion sort. c. Selection sort
WEEK III	**SORTING TECHNIQUES**
	Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Quick sort. b. Merge sort.
WEEK IV	**IMPLEMENTATION OF STACK AND QUEUE**
	Write Python programs to a. Design and implementation Stack and its operations using Arrays. b. Design and implementation Queue and its operations using Arrays
WEEK V	**APPLICATIONS OF STACK**
	Write Python programs for the following: a. Uses Stack operations to convert infix expression into postfix expression. b. Uses Stack operations for evaluating the postfix expression.
WEEK VI	**IMPLEMENTATION OF SINGLE LINKED LIST**
	Write Python programs for the following: a. Uses functions to perform the following operations on single linked list. (i) Creation (ii) insertion (iii) deletion (iv) traversal b. To store a polynomial expression in memory using linked list.
WEEK VII	**IMPLEMENTATION OF CIRCULAR SINGLE LINKED LIST**
	Write Python programs for the following: Uses functions to perform the following operations on Circular linked list. (i) Creation (ii) insertion (iii) deletion (iv) traversal
WEEK VIII	**IMPLEMENTATION OF DOUBLE LINKED LIST**
	Write Python programs for the following: Uses functions to perform the following operations on double linked list. (i) Creation (ii) insertion (iii) deletion (iv) traversal in both ways.
WEEK IX	**IMPLEMENTATION OF STACK USING LINKED LIST**
	Write Python programs to implement stack using linked list.
WEEK X	**IMPLEMENTATION OF QUEUE USING LINKED LIST**
	Write Python programs to implement queue using linked list.
WEEK XI	**GRAPH TRAVERSAL TECHNIQUES**
	Write Python programs to implement the following graph traversal algorithms: a. Depth first search. b.Breadth first search.

WEEK XII	**IMPLEMENTATION OF BINARY SEARCH TREE**
	Write a Python program that uses functions to perform the following: a. Create a binary search tree. b.Traverse the above binary search tree recursively in pre-order, post-order and in-order. c. Count the number of nodes in the binary search tree.

TEXTBOOKS

1. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.
2. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers, 2017.

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1. Michael H Goldwasser, David Letscher, —Object Oriented Programming in Python‖, Prentice Hall, 1 st Edition, 2007.
2. Yashavant Kanetkar, Aditya Kanetkar, —Let us Python‖, BPB publication, 1st Edition, 2019.
3. Ashok Kamthane, Amit Kamthane, —Programming and Problem Solving with Python‖, McGraw Hill Education (India) Private Limited, 2018.
4. Taneja Sheetal, Kumar Naveen, —Python Programming – A modular approach‖, Pearson, 2017.
5. R Nageswara Rao, —Core Python Programming‖, Dreamtech Press, 2017 Edition.

WEB REFERENCES:

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2. https://python.swaroopch.com/oop.html
3. https://python-textbok.readthedocs.io/en/1.0/Object-Oriented-Programming.html
4. https://www.programiz.com/python-programming/
5. . https://www.geeksforgeeks.org/python-programming-language

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Searching Techniques	CO 1	T1
2	Sorting Techniques.	CO 2	T1
3	Sorting Techniques	CO 2	T1,T2
4	Implementation of Stack and Queue	CO 3	T1,T2
5	Applications of Stack.	CO 3	T1, W1
6	Implementation of Single Linked List	CO 4	T1,W2
7	Implementation of Circular Single Linked List.	CO 4	T1,W3

8	Implementation of Double Linked List	CO 4	T2,W3
9	Implementation of Stack Using Linked List.	CO 3,CO 4	T2,W2
10	Implementation of Queue Using Linked List	CO 3,CO 4	T2,W5
11	Graph Traversal Techniques.	CO 6	T2,W2
12	Implementation of Binary Search Tree	CO 5	T1,W5

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	**Twin vortex formation:** Design a Data Structure SpecialStack that supports all the stack operations like push(), pop(), isEmpty(), isFull() and an additional operation getMin() which should return minimum element from the SpecialStack. All these operations of SpecialStack must be O(1). To implement SpecialStack, you should only use standard Stack data structure and no other data structure like arrays, list, . etc.
2	**Open channel:** In class, we studied binary search trees that do not allow us to insert duplicate elements. However, sometimes we do need to store duplicates. For example, a database of student marks might contain one record for every mark by every student; so if you've taken two courses, there will be two records with the same key (your student number) and different data (your two marks). To accomplish this, we might use a data structure called a "BST with duplicates", or BSTD
3	**Capillary action:** The variable tos in the Stack class is the index of the array element that would be filled the next time push() is called. Modify the code so that tos is the index of the top element actually in use. In other words, tos is to be the index of the top array element occupied by a value that has been "pushed" onto the stack. Write your changes on the code above. Don't forget to fix the comments. You do not need to add preconditions as in part-a.
4	**Buoyancy** Given an adjacency matrix representation of a graph, describe with pseudo code an algorithm that finds a single path, if one exists, between any two different vertices.
5	**Flow through pipes:** There is a garage where the access road can accommodate any number of trucks at one time. The garage is building such a way that only the last truck entered can be moved out. Each of the trucks is identified by a positive integer (a truck-id). Write a program to handle truck moves, allowing for the following commands: a) On-road (truck-id); b) Enter-garage (truck- id); c) Exit-garage (truck-id); d) Show-trucks (garage or road); If an attempt is made to get out a truck which is not the closest to the garage entry, the error message Truck x not near garage door

Signature of Course Coordinator **HOD,CSE**
Mrs. K LAXMINARAYANAMMA, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Course Title	**DATABASE MANAGEMENT SYSTEMS**				
Course Code	AITC05				
Program	B.Tech				
Semester	IV	CSE			
Course Type	Core				
Regulation	UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Mrs. A. Rajitha, Assistant Professor				

I COURSE OVERVIEW:

Database management system is intended to provide a clear understanding of fundamentals with emphasis on their applications to create and manage large data sets. It emphasizes on technical overview of database software to retrieve data from database. This includes database design principles, normalization, and concurrent transaction processing, security, recovery and file organization techniques. This will provide adequate knowledge to understand future evolutions of data technologies.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB01	II	Programming for Problem Solving
B.Tech	ACSB03	III	Data Structures

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Database Management Systems	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Concept Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

Continuous Internal Assessment (CIA): CIA is conducted for a total of 30 marks (Table 2), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool Table 3.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Percentage of Cognitive Level	Blooms Taxonomy Level
33 %	Remember
27 %	Understand
33 %	Apply
07 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Examination (CIE): Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 20 marks of 2hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz –Online Examination: Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT): This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.The AAT chosen for this course is given in table 3.

ASSESSMENT PATTERN FOR AAT:

5 Minutes Video	Assignment	Tech-talk	Seminar	Open Ended Experiment
20%	30%	30 %	10%	10%

VI COURSE OBJECTIVES:

The students will try to learn:

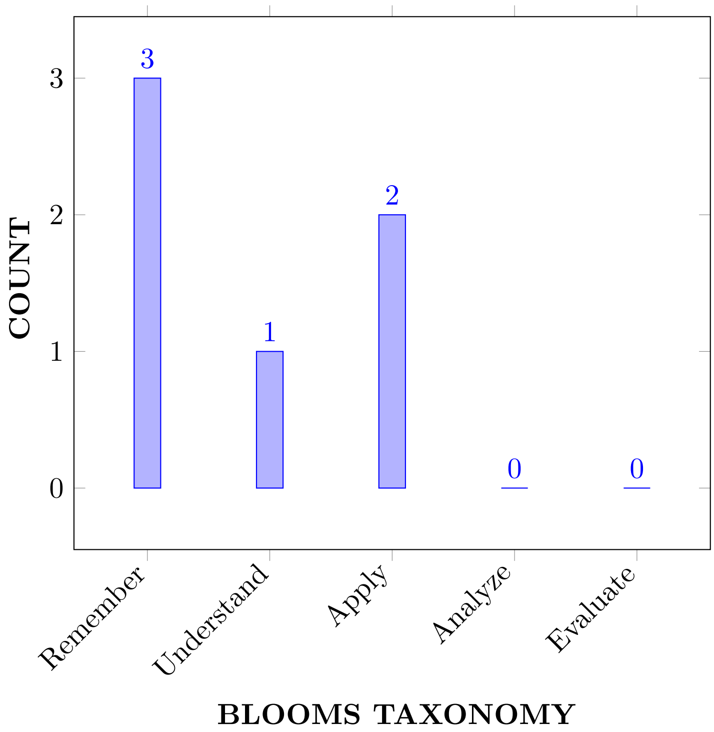
I	Acquire analytical thinking and identify efficient ways of designing database by encapsulating data requirements for business and organizational scenarios.
II	Develop expertise in database language SQL to develop sophisticated queries to extract information from large datasets.
III	Enhance skills to develop and manage data in solving related engineering problems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Describe** data models, schemas, instances, view levels and database architecture for voluminous data storage.	Remember
CO 2	**Define** the concept of Relational Algebra and Relational Calculus from set theory to represent queries.	Remember
CO 3	**Make Use of** SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation.	Apply
CO 4	**Illustrate** the definition of Functional Dependencies, Inference rules and minimal sets of FD's to maintain data integrity.	Understand
CO 5	**State** the concepts of transaction, states and ACID properties in data manipulation.	Remember
CO 6	**Apply** indexing ,hashing techniques to access the records from the file effectively.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT
PO 3	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions..	3	CIE/Quiz/AAT
PO 4	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction analysis and interpretation of data, and synthesis of the information to provide valid conclusions and modeling to complex engineering activities with an understanding of the limitations.	3	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	**Design** next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, knowledge discovery tools.	2	Industry exposure/AAT

3 = High; 2 = Medium; 1 = Low

X MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	-	✓	✓	✓	-	-	-	-	-	-	-		✓	-	-
CO 5	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	✓	-	-	-	-	-	-	-	-	-	-		-	-	-

XI JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Describe data models, schemas, instances, view levels and database architecture for voluminous data storage using principles of **mathematics, science, and engineering fundamentals.**	3
	PO 2	Describe data models, schemas, instances, view levels and database architecture for voluminous data storage with Problem statement and system definition , **Problem formulation and abstraction**	2
CO 2	PO 1	Define the concept of Relational Algebra and Relational Calculus from set theory to represent queries with **knowledge of mathematics, science and engineering fundamentals for capacitance calculation.**	3
CO 3	PO 2	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation with the Problem statement and system definition, Problem formulation and **abstraction , Information and data collection, Model translation**	4
	PO 3	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation with the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes,	3
	PO 4	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation by Understanding of contexts in which **engineering knowledge can be applied, Understanding use of technical literature** , Understanding of appropriate codes of practice and industry standards.	3
	PSO 1	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation by using a set of steps.	1
CO 4	PO 1	Illustrate the definition of Functional Dependencies, Inference rules and minimal sets of FD's to maintain data integrity basic fundamentals of **mathematics and engineering fundamentals.**	2
	PO 2	Illustrate the definition of Functional Dependencies, Inference rules and minimal sets of FD's to maintain data integrity with the Problem statement and system **definition, Problem formulation and abstraction ,** Information and data collection, Model translation	4
CO 5	PO 1	State the concepts of transaction, states and ACID properties in data manipulation basic fundamentals of **mathematics and engineering fundamentals.**	2

	PO 2	State the concepts of transaction, states and ACID properties in data manipulation the Problem statement and system definition, Problem formulation and abstraction , **Information and data collection, Model translation**	4
CO 6	PO 1	Apply indexing ,hashing techniques to access the records from the file effectively with basic fundamentals of**mathematics and engineering fundamentals.**	2
	PO 2	Apply indexing ,hashing techniques to access the records from the file effectively through statement and system definition, Problem formulation and abstraction ,**Information and data collection, Model translation**	4
	PO 3	Apply indexing ,hashing techniques to access the records from the file effectively by Investigate and define a problem and identify constraints,**Understand customer and user needs, Manage the design process and evaluate outcomes,**	4
	PSO 1	Apply indexing ,hashing techniques to access the records from the file effectively by using a set of instructions	1

XII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	Program Outcomes/ No. of Key Competencies Matched											PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	-	4	3	4	-	-	-	-	-	-	-	-	-	1	-
CO 4	2	4	-	3	-	-	-	-	-	-	-		1	-	-
CO 5	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	2	4	4	-	-	-	-	-	-	-	-		-	1	-

XIII PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	100	20.0	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	100	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	-	40.0	30.0	36.36	-	-	-	-	-	-	-		-	50	-
CO 4	66.6	40.0	40.0	27.27	-	-	-	-	-	-	-		16.66	-	-
CO 5	66.6	40.0	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	66.6	40.0	40.0	-	-	-	-	-	-	-	-		-	50	-

XIV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.
0 - $0 \leq C \leq 5\%$ – No correlation
2 - $40\% < C < 60\%$ –Moderate
1-5 $< C \leq 40\%$ – Low/ Slight
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	**PROGRAM OUTCOMES**												**PSO'S**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	1	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	-	1	1	1	-	-	-	-	-	-	-	-	-	2	-
CO 4	3	1	1	1	-	-	-	-	-	-	-		1	-	-
CO 5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	1	1	-	-	-	-	-	-	-	-		-	2	-
TOTAL	**15**	6	3	2	-	-	-	-	-	-	-	-	1	4	-
AVERAGE	**3.0**	1	1	1	-		-	-	-	-	-	-	1.0	2	-

XV ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1,PO 2	SEE Exams	PO 1,PO 2	Seminars	PO 1
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	PO 1,PO 2, PO 5	5 Minutes Video	PO 10	Open Ended Experiments	-
Assignments	-				

XVI ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVII SYLLABUS:

MODULE I	**CONCEPTUAL MODELING INTRODUCTION**
	Introduction to Data bases: Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Various Components of overall DBS architecture, Various Concepts of ER Model, Basics of Relational Model.

MODULE II	**RELATIONAL APPROACH**
	Relational algebra and calculus: Relational algebra, selection and projection, set operations, renaming, joins, division, examples of algebra queries, relational calculus: Tuple relational calculus, Domain relational calculus, expressive power of algebra and calculus.
MODULE III	**SQL QUERY - BASICS, RDBMS NORMALIZATION**
	SQL – Data Definition commands, Queries with various options, Mata manipulation commands, Views, Joins, views, integrity and security; Relational database design: Pitfalls of RDBD, Lossless join decomposition, Functional dependencies , Armstrong Axioms, Normalization for relational databases 1st 2nd and 3rd normal forms, Basic definitions of MVDs and JDs, 4th and 5th normal forms.
MODULE IV	**TRANSACTION MANAGEMENT**
	Transaction processing: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability. Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols,Multiple Granularity, Multiversion Schemes, Deadlock Handling. Recovery: Failure Classification, Storage Structure ,Recovery and Atomicity, Log-Based Recovery,Shadow Paging, Recovery With Concurrent Transactions Buffer Management.
MODULE V	**DATA STORAGE AND QUERY PROCESSING**
	Data storage: Overview of Physical Storage Media, Magnetic Disks, Storage Access, File Organization,Organization of Records in Files.Indexing and Hashing: Basic Concepts: Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing.Query Processing: Overview, Measures of Query Cost.

TEXTBOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill 6th Edition, 2017

REFERENCE BOOKS:

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 6th Edition, 2014.

2. Raghu Ramakrishnan, "Database Management System", Tata McGraw Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 3rd Edition, 2007

3. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States, 1st Edition, 2000.

4. Peter Rob, Corlos Coronel, "Database System, Design, Implementation and Management", Thompson Learning Course Technology, 5th Edition, 2003.

XVIII COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
1-2	Introduction, Data base System Applications, Purpose of data base Systems, View of Data – Data Abstraction, Instances and Schemas Data Models, Database Languages, Data base access for applications Programs	CO 1,CO 2	T2: 1.1-1.5
3-4	Transaction Management component of DB architecture, Data base users, History of database systems, Database design, ER Diagrams.	CO 3,CO 4	T2:1.6 -1.8 T1: 2.1
5-6	Entities, Attributes and entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual design with ER model, Conceptual design for large enterprises	CO 4	T1: 2.2-2.6
7-8	Relational Model: Introduction to the Relational Model – Integrity Constraint Over relations, Enforcing Integrity constraints – Querying relational data	CO 5	T1: 3.1-3.7
9-10	Relational Algebra and Calculus: Relational Algebra – Selection and projection –set operations – renaming, Joins – Division	CO 6,CO 6	T1:4.1,4.2.2
11-12	Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.	CO 2,CO 2	T1:4.3, 4.4
13-14	Form of Basic SQL Query – Examples of Basic SQL Queries Comparison Operators – Aggregative Operators, NULL values , Logical connectivity's – AND, OR and NOT, complex Integrity Constraints in SQL	CO 3	T1: 5.2-5.5
15-16	Introduction to Nested Queries – Correlated Nested Queries Set Comparison Operators – Aggregative Operators, Triggers and Active Data bases	CO 3	T1: 5.6-5.8
17-18	Introduction to Schema refinement – Problems Caused by redundancy ,Decompositions – Problem related to decomposition	CO 4	T1: 9.1,19.1.3
19-21	Functional dependencies, reasoning about FDS ,Lossless join Decomposition ,Dependency preserving Decomposition	CO 3	T2: 19.4-19.8
22-25	Schema refinement in Data base Design, Normal Forms, MVDs, JDs	CO 3	T2: 19.8-19..9
26-29	Transaction Management: Transaction Concept-Transaction State-Implementation of atomicity and Durability, Concurrent Executions, Serializability , Recoverability, Implementation of Isolation, Testing for Serializability.	CO 4	T2:15.1-15.29

30-33	Concurrency Control: Lock-Based Protocols –time Stamp Based protocols-,Validation Based Protocols-Multiple Granularity	CO 5	T2: 16.1, 16.2 T2: 16.3, 16.4
34-37	Recovery System-Failure Classification-storage Structure recovery and Atomicity-Log Based Recovery	CO 4	T2:17.1-17.10
38-39	Overview of Storage and Indexing: Data on External Storage File Organization and Indexing – Cluster Indexes, Primary and Secondary Indices	CO 5	T1: 8.1,8.2
40-42	Index data Structures – Hash Based Indexing ,Tree base Indexing – Comparison of File Organizations, ISAM	CO 6,CO 4	T1: 8.3-8.4
43-45	Tree Structured Indexing: B+ Trees, Hashing	CO 6	T1: 10 10.2

Signature of Course Coordinator **HOD,CSIT**
Mrs.A.Rajitha, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**OPERATING SYSTEMS**				
Course Code	ACSC12				
Program	B.Tech				
Semester	IV				
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms. A Harika, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC04	II	Programming for Problem Solving using C
B.Tech	ACSC07	III	Computer Organization and Architecture

II COURSE OVERVIEW:

This course emphasizes on basic knowledge of various types of operating systems, effective resource utilization by using systems and applications software. It is designed to provide in-depth critique on the problems of resource management, scheduling, concurrency, synchronization, memory management, file management, protection and security of used system. Learned knowledge will be implemented in design and development of hybrid operating systems, command control systems, and in real time environments.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Operating Systems	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
45 %	Understand
18 %	Apply
27 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

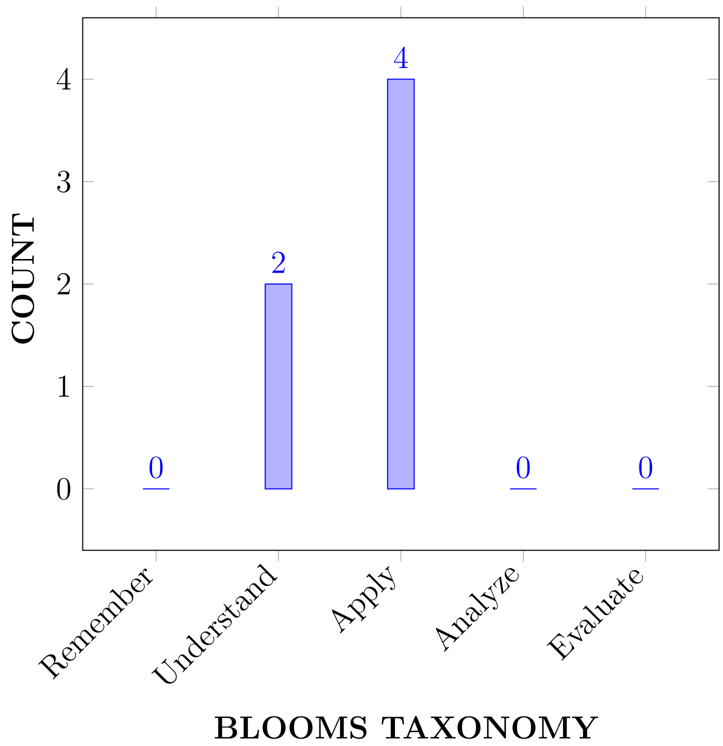
I	The principles of operating systems, services and functionalities with its evolution.
II	The structures, functions and components of modern operating systems
III	The conventional hardware at different OS abstraction levels.
IV	The essential skills to examine issues and methods employed in design of operating systems with identification of various functionalities.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Illustrate** different architectures used in design of modern operating systems.	Understand
CO 2	**Solve** problems related to process scheduling, synchronization and deadlock handling in uni and multi-processing systems.	Apply
CO 3	**Choose** memory allocation algorithms for effective utilization of resources.	Apply
CO 4	**Select** various page replacement algorithms applied for allocation of frames.	Apply
CO 5	**Make use of** different file allocation and disk scheduling algorithms applied for efficient utilization of storage.	Apply
CO 6	**Outline** mechanisms used in protection of resources in real time environment	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	SEE / CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE / CIE / AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	SEE / CIE / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	SEE / CIE / AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	1	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	2	SEE/AAT
PSO 2	Focus on improving software reliability, network security / information retrieval systems.	3	SEE/AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	✓	-	✓	✓	-	✓
CO 2	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	✓	-
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 4	✓	✓	✓	✓	-	-	-	-	-	✓	-	-	✓	-	-
CO 5	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	-	-
CO 6	✓	-	-	-	-	-	-	-	-	✓	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Understand the structure and evolution of operating system by understanding fundamentals of Computer engineering specialization and mathematical and scientific principles.	3
	PO 10	Communicate effectively on evolution of operating systems including deep subject knowledge.	1
	PO 12	By understanding different operating system architectures, one can personally continue understanding of different operating systems developed by the companies to stay up with new technology and for personal development.	2
	PSO 1	Identify the need, key issues and applications of the operating system in various real time environments.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 3	By understanding different operating system architectures, one can acquire knowledge on advanced operating systems for engineering practice and higher education and even can extend the knowledge to become an entrepreneur.	2
CO 2	PO 1	Understand the concept of Process, process scheduling, issues and their solutions related to process synchronization by using mathematical principles, fundamental of Computer engineering specialization and scientific principles.	3
	PO 2	Identify synchronization problem and understand the problem statement of classical synchronization problems collect the data needed for solving the problem then analyze different models of solutions for classical synchronization problems by semaphores and monitors and interpret the solutions	6
	PO 3	Define the process synchronization problem, understand the user needs then identify the resources required next manage the design process using banker's algorithm and evaluate outcomes.	4
	PO 4	By having the knowledge of characteristics of process and understanding the context in classical synchronization problems and the solutions provided using the technical constructs like semaphores and monitors with their working strategies, these can be applied for understanding of other synchronization problems.	5
	PO 10	Communicate effectively on process communication using process communication techniques and explaining each technique.	2
	PO 12	By understanding process management, one can personally continue understanding internal functioning of operating systems developed by the companies to stay up with new technology and for personal development.	2
	PSO 1	Identify the need for process scheduling and apply appropriate algorithms for scheduling of process arriving at various time intervals.	4
	PSO 2	By acquiring knowledge of process management one can design software applications with reliability and applications with fast information retrieval.	2
CO 3	PO 1	Describe the need and various techniques for memory management by understanding the limits of contiguous memory allocation through applying mathematical principles, fundamental of Computer engineering specialization and scientific principles	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 2	Identify problem of memory management and understand the problem statement of contiguous memory management then analyze different models of non-contiguous memory management.	3
	PO 3	Define the problem related to contiguous memory management, understand the user needs then identify the memory requirements of each process next manage the design process by using non-contiguous memory management techniques and evaluate outcomes.	4
	PO 10	Communicate effectively on memory management techniques with clarity on contiguous and varied strategies and explaining each technique with appropriate terminology.	2
‘	PSO 1	Identify the need of efficient utilization of main memory and apply various contiguous and non-contiguous memory allocation techniques of memory management.	4
CO 4	PO 1	Understand the concept of virtual memory and various algorithms for effective usage of memory by applying the knowledge of computer engineering fundamentals, mathematical and scientific principles.	3
	PO 2	Identify the need for page replacement, understand the problem statement of allocation of pages to frames, then collect the data related to available pages and frames then analyze various models for solving problem based on the given sequence of pages and interpret their results accordingly.	6
	PO 3	Define the problem of mapping of large virtual memory to the existing physical memory, understand the user needs then manage the design process using page replacement algorithms and evaluate outcomes by identifying the number of page faults incurred.	4
	PO 4	By understanding characteristics of process, understanding the context in virtual memory management using demand paging and segmentation, this knowledge can be applied for virtualizing engineering process.	4
	PO 10	Communicate on utilization of main memory using pictorial representation of demand paging and segmentation and explaining them in detail.	2
	PSO 1	Identify the need of separation of logical memory from physical memory and apply appropriate algorithms for allocating given sequence of pages to frames.	4
CO 5	PO 1	Understand the concept of file system and analyze various file allocation methods by using the knowledge of computer engineering fundamentals, mathematical and scientific principles.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 2	Identify the need for disk scheduling, understand the problem statement of disk scheduling, then collect the data related to location of data to be accessed in the disk structure then analyze different scheduling algorithm models used for solving problems related to finding total head movements and interpret their results.	6
	PO 3	Define the problem of file allocation to disk block, understand the user needs then identify the free disk space available next manage the design process by using appropriate file allocation methods.	4
	PO 10	Communicate on effective utilization of mass storage structures clearly using pictorial representation of disk structure.	2
	PO 12	By understanding mass storage structure, one can personally continue understanding of different storage devices developed by the companies to stay up with new technology.	2
	PSO 1	Identify the need of scheduling the service of disk I/O requests and apply appropriate algorithms for processing I/O requests.	4
CO 6	PO 1	Explain the importance of protection of objects and the protection provided for them by using domain concept in terms of access matrix implementation by applying knowledge of computer science fundamentals.	1
	PO 10	Communicate on protection of computer system components using protection strategies in detail.	1
	PO 12	By understanding the concept of protection, one can study and analyze various protection mechanisms developed recently for personal development.	2
	PSO 1	Identify the need of protection provided to the hardware and software components of the computer system and analyze the techniques provided for their protection.	1
	PSO 2	By acquiring knowledge of protection one can design software applications with high security and reliability.	1
	PSO 3	By understanding the concept of protection, one can acquire knowledge on advanced protection mechanisms for engineering practice and higher education and even can extend the knowledge to become an entrepreneur.	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	1	-	2	1	-	2
CO 2	3	6	4	5	-	-	-	-	-	2	-	2	4	2	-
CO 3	3	3	4	-	-	-	-	-	-	2	-	-	4	-	-
CO 4	3	6	4	4	-	-	-	-	-	2	-	-	4	-	-
CO 5	3	6	4	-	-	-	-	-	-	2	-	2	4	-	-
CO 6	1	-	-	-	-	-	-	-	-	1	-	2	1	1	2

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	20	-	25	17		100
CO 2	100	60	40	45	-	-	-	-	-	40	-	25	67	100	-
CO 3	100	30	40	-	-	-	-	-	-	40	-	-	67	-	-
CO 4	100	60	40	36	-	-	-	-	-	40	-	-	67	-	-
CO 5	100	60	40	-	-	-	-	-	-	40	-	25	67	-	-
CO 6	33	-	-	-	-	-	-	-	-	20	-	25	17	50	100

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -$5 < C \leq 40\%$ – Low/ Slight

2 - $40\ \% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	1	-	1	1	-	3
CO 2	3	3	2	2	-	-	-	-	-	2	-	1	3	3	-
CO 3	3	1	2	-	-	-	-	-	-	2	-	-	3	-	-
CO 4	3	3	2	2	-	-	-	-	-	2	-	-	3	-	-
CO 5	3	3	2	-	-	-	-	-	-	2	-	1	3	-	-
CO 6	1	-	-	-	-	-	-	-	-	1	-	1	1	2	3
TOTAL	16	10	8	4	-	-	-	-	-	10	-	4	14	5	6
AVERAGE	2.7	2.5	2	2	-	-	-	-	-	1.7	-	1	2.3	2.5	3

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION**
	Operating systems objectives and functions: Computer system architecture, operating systems structure, operating systems operations; Evolution of operating systems: Simple batch, multi programmed, time shared, personal computer, parallel distributed systems, real time systems, special purpose systems, operating system services, user operating systems interface; Systems calls: Types of systems calls, system programs, protection and security, operating system design and implementation, operating systems structure, virtual machines.
MODULE II	**PROCESS AND CPU SCHEDULING, PROCESS COORDINATION**
	Process concepts: The process, process state, process control block, threads; Process scheduling: Scheduling queues, schedulers, context switch, preemptive scheduling, dispatcher, scheduling criteria, scheduling algorithms, multiple processor scheduling; Real time scheduling; Thread scheduling; Case studies Linux windows; Process synchronization, the critical section problem; Peterson‘s solution, synchronization hardware, semaphores and classic problems of synchronization, monitors.
MODULE III	**MEMORY MANAGEMENT AND VIRTUAL MEMORY**
	Logical and physical address space: Swapping, contiguous memory allocation, paging, structure of page table. Segmentation: Segmentation with paging, virtual memory, demand paging; Performance of demand paging: Page replacement, page replacement algorithms, allocation of frames, thrashing
MODULE IV	**FILE SYSTEM INTERFACE, MASS-STORAGE STRUCTURE**
	The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure, file system implementation, allocation methods, free space management, directory implementation, efficiency and performance; Overview of mass storage structure: Disk structure, disk attachment, disk scheduling, disk management, swap space management; Dynamic memory allocation: Basic concepts; Library functions.

MODULE V	**DEADLOCKS, PROTECTION**
	System model: Deadlock characterization, methods of handling deadlocks, deadlock prevention, dead lock avoidance, dead lock detection and recovery form deadlock system protection, goals of protection, principles of protection, domain of protection, access matrix, implementation of access matrix, access control, revocation of access rights, capability based systems, language based protection.

TEXTBOOKS

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Principles‖, Wiley Student Edition, 8th Edition, 2010.

2. . William Stallings, Operating System- Internals and Design Principles‖, Pearson Education, 6th Edition, 2002.

REFERENCE BOOKS:

1. Andrew S Tanenbaum, Modern Operating Systems‖, PHI, 3rd Edition, 2007.

2. D. M. Dhamdhere, Operating Systems a Concept based Approach, Tata McGraw-Hill, 2nd Edition, 2006.

WEB REFERENCES:

1. www.smartzworld.com/notes/operatingsystems
2. www.scoopworld.in
3. www.sxecw.edu.in
4. www.technofest2u.blogspot.com

COURSE WEB PAGE:

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
2	Computer system architecture, operating systems structure	CO 1	T1:1.1-1.4
3	operating systems operations	CO 1	T1:1.5
4	Evolution of operating systems: Simple batch, multi programmed, time shared, personal computer	CO 1	T2:2.2
5	parallel distributed systems, real time systems, special purpose systems,	CO 1	T2:2.2

6	operating system services, user operating systems interface	CO 1	T2:2.1-2.2
7	Systems calls: Types of systems calls, system programs	CO 1	T2:2.3-2.5
8	protection and security, operating system design and implementation	CO 1	T1:2.6
9	operating systems structure, virtual machines.	CO 1	T1:2.7-2.8
10	Process concepts: The process, process state	CO 2	T1:3.1-3.2
11	process control block, threads;	CO 2	T1:3.2-3.4
12	Process scheduling: Scheduling queues, schedulers, context switch	CO 2	T1:5.2
13	preemptive scheduling, dispatcher, scheduling criteria	CO 2	T1:5.3
14	scheduling algorithms	CO 2	T1:5.3
15	multiple processor scheduling	CO 2	T1:5.3
17	Real time scheduling; Thread scheduling;	CO 2	T1:5.4-5.5
18	Case studies Linux windows	CO 2	T1:5.6, 21.4
19	Process synchronization, the critical section problem	CO 2	T1:6.1
20	Peterson‘s solution	CO 2	T1:6.2-6.3
21	synchronization hardware	CO 2	T1:6.4
22	semaphores	CO 2	T1:6.5
23	classic problems of synchronization, monitors.	CO 2	T1:6.6-6.7
24	Logical and physical address space: Swapping, contiguous memory allocation	CO 3	T1:8.1
26	paging, structure of page table	CO 3	T1:8.2
27	Segmentation: Segmentation with paging	CO 3	T1:8.3
29	virtual memory, demand paging	CO 3	T1:8.4-8.5
30	Performance of demand paging	CO 3	T1:8.6
31	Page replacement, page replacement algorithms,	CO 4	T1:8.6
33	allocation of frames	CO 4	T1:9.5
34	Thrashing	CO 4	T1:9.6
35	The concept of a file, access methods	CO 4	T1:10.1-10.2
36	directory structure	CO 4	T1:10.3
37	file system mounting	CO 4	T1:10.5
38	file sharing, protection	CO 4	T1:10.6
39	file system structure	CO 4	T1:10.6
40	file system implementation	CO 4	T1:11.3
41	allocation methods	CO 4	T1:11.4

43	free space management	CO 4	T1:11.5
44	directory implementation, efficiency and performance	CO 4	T1:11.6
45	Overview of mass storage structure: Disk structure, disk attachment	CO 5	T1:12.1-12.3
46	disk scheduling, disk management, swap space management	CO 5	T1:12.4-12.6
48	Dynamic memory allocation: Basic concepts; Library functions.	CO 5	T1:12.7-12.8
49	System model: Deadlock characterization, methods of handling deadlocks	CO 2	T1:7.1-7.2
50	deadlock prevention	CO 2	T1:8.1
51	deadlock avoidance	CO 2	T1:8.2
52	dead lock detection and recovery form deadlock system protection	CO 2	T1:8.3
55	goals of protection, principles of protection, domain of protection	CO 6	T2:27.8
56	access matrix, implementation of access matrix, access control, revocation of access rights	CO 6	T2:27.9
57	capability based systems, language based protection	CO 6	T1:8.2-8.3
PROBLEM SOLVING/ CASE STUDIES			
16	Problems on CPU scheduling algorithms	CO 2	T1:5.3-5.3
25	Problems on contiguous memory allocation	CO 3	T1:8.1-8.3
28	Problems on paging and segmentation	CO 3	T1:8.4-8.6 T1:9.1-9.2
32	Problems on page replacement algorithms	CO 4	T1:9.4-9.6
42	Problems on file allocation methods	CO 5	T1:11.3-11.6
47	Problems on disk scheduling	CO 5	T1:12.1-12.6
53	Problems on deadlock avoidance	CO 2	T1:8.1-8.3
54	Problems on recovery from deadlocks	CO 2	T1:8.1-8.3
DISCUSSION OF DEFINITION AND TERMINOLOGY			
58	Definitions on operating systems fundamentals	CO 1	T1:1.2
59	Definitions on process, CPU scheduling and process coordination	CO 2	T1:1.5
60	Definitions on memory management and virtual memory	CO 3, CO 4	T1:8,9

61	Definitions on file system interface and mass storage structure	CO 5	T1:10,11
62	Definitions on deadlocks and protection	CO 2, CO 6	T1:9.1
DISCUSSION OF QUESTION BANK			
1	Introduction	CO 1	T1:1.2
2	Process and CPU Scheduling, Process Coordination	CO 2	T1:1.5
3	Memory Management and Virtual Memory	CO 3,4	T1:8,9
4	File System Interface, Mass Storage Structure	CO 5	T1:10,11
5	Deadlocks, Protection	CO 2,6	T1: 9.1

Signature of Course Coordinator **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	COMPUTER SCIENCE AND ENGINEERING					
Course Title	**THEORY OF COMPUTATION**					
Course Code	AITC04					
Program	B.Tech					
Semester	IV					
Course Type	Core					
Regulation	UG-20					
Course Structure	Theory			Practical		
	Lecture	Tutorials	Credits	Laboratory	Credits	
	3	1	4	-	-	
Course Coordinator	Mr. U Sivaji, Assistant Professor					

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSC08	II	Probability and Statistics.
B.Tech	ACSB03	III	Data Structures
B.Tech	ACSB04	III	Discrete Mathematical Structures

II COURSE OVERVIEW:

This course focuses on infinite languages in finite ways, and classifies machines by their power to recognize. It includes finite automata, regular grammar, push down automata, context free grammars, and Turing machines It is applicable in designing phrasing and lexical analysis of a compiler, genetic programming and recursively enumerable languages

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Theory of computation	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Quiz						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could

be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
20%	Remember
20 %	Understand
0%	Apply
0%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

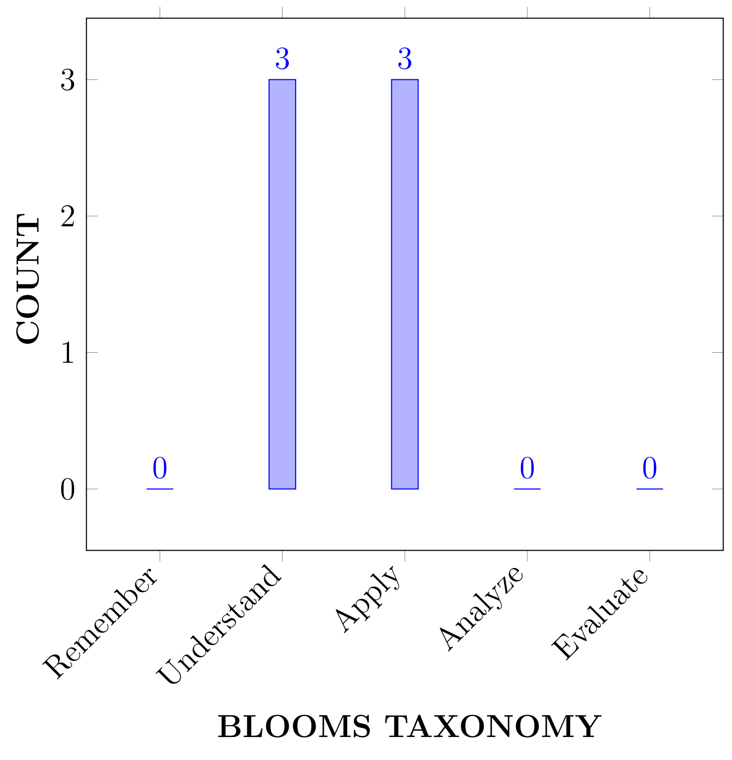
I	The fundamental knowledge of automata theory which is used to solve computational problems
II	The reorganization of context free language for processing infinite information using push down automata.
III	The computer based algorithms with the help of an abstract machine to solve recursively Enumerable problems

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Make use of** deterministic finite automata and non deterministic finite automata for modeling lexical analysis and text editors.	Apply
CO 2	**Extend** regular expressions and regular grammars for parsing and designing programming languages.	Understand
CO 3	**Illusrate** the pumping lemma on regular and context free languages for perform negative test .	Understand
CO 4	**Demonstarte** context free grammars, normal forms for generating patterns of strings and minimize the ambiguity in parsing the given strings.	Understand
CO 5	**Construct** push down automata for context free languages for developing parsing phase of a compiler.	Apply
CO 6	**Apply** Turing machines and Linear bounded automata for recognizing the languages,complex problems.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Program Outcomes	
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1.2	AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1.5	SEE / AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	CIE / Quiz / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1.5	CIE / Quiz / AAT /Tech-Talk

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	2.3	Group discussion/ Short term courses
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	1.0	Research papers/ Industry exposure

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	-	✓
CO 2	✓	-	-	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 3	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	✓	-	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 5	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	✓
CO 6	✓	✓	✓	✓		-	-	-	-	-	-	-	✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Evaluate properties of grammar for the given problem with the help of alphabet and strings and language by applying the mathematical principles and scientific principles.	2
	PSO 3	Demonstrate the basic text editors in real world software, using industry standard tools and collaboration techniques in the field of computational programming.	1
CO 2	PO 1	Understand the basics of context free grammars, its types and properties for finding pumping lemma by applying mathematical principles and scientific principles.	2
	PO 10	Understand the types of grammars and their properties and write effective reports and documentation .	1
	PSO 1	Make use of the concept of finite automata for developing algorithms of machine learning and networking concepts..	3
CO 3	PO 1	Find an optimized solution for the given problem using regular grammar by applying the knowledge of mathematical principles and computer engineering methodologies.	2
	PO 2	Understand the given problem and develop the solution using right and left linear grammar from the provided information and interpret of results.	4
	PO 3	Explain and demonstrate the translation of simple statements, by applying grammars by engineering processes.	2
CO 4	PO 1	Describe the role of Ambiguity in construction of context free grammars by understanding mathematical principles and scientific principles.	2
	PO 2	Understand the given problem and analyze the grammar and eliminate ambiguity using derivation trees and document the results for interpretation. .	3
	PO 10	Understand normalization techniques such as (Chomsky and griebach)to minimize the ambiguity.	1
	PSO 1	Understand the normalization techniques in the area related to parsing desire for higher studies in field of compiler design, machine Learning and data science.	3
CO 5	PO 1	Describe acceptance of context free language by final state and by empty stack problems by understanding mathematical principles, engineering methodologies and scientific principles.	3
	PO 2	Understand equivalence of context free language and pushdown automata for validation and design of inter conversionforsolving the given problem related to engineering from the provided information and data.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 3	Understand the principle of languages , grammars for computational programming to achieve engineering objectives.	1
CO 6	PO 1	Describe the recursively enumerable languages and churchs hypothesis using mathematical principles and scientific principles.	3
	PO 2	Understand the given problem statement and formulate the (complex) engineering problems in the Design of Turing machine in reaching substantiated conclusions by the interpretation of results.	3
	PO 3	Make Use ofTuring machinesto develop programs (define problem)for finding the solution (innovative) of complex engineering problems which satisfy the user constraints.	4
	PO 4	Ability to identify ,classify and describe the performance of turing machine by using analytical methods and modeling techniques.	4
	PSO 1	Analyze computable functions in the areas related to simulation of Turing machine, software testing, high performance computing, machine learning, software engineering and computer networks	6

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-		-	-	1
CO 2	2	-	-	-	-	-	-	-	-	1	-	-	3	-	-
CO 3	2	4	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	3	-	-		-	-	-	-	1	-	-	3	-	-
CO 5	2	3	2	-	-	-	-	-	-	-	-	-	-	-	1
CO 6	3	3	4	4	-	-	-	-	-	-	-		6	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.7	-	-	-	-	-	-	-	-	-	-		-	-	33.3
CO 2	66.7	-	-	-	-	-	-	-	-	20.0	-	-	50.0	-	-
CO 3	66.7	40.0	20.0	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	66.7	30.0	-	-		-	-	-	-	20.0	-	-	50.0	-	-
CO 5	100.0	30.0	-	-	-	-	-	-	-	-	-	-	-	-	33.3
CO 6	100.0	30.0	40.0	36.3		-	-	-	-	-	-		100.0	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -5 $< C \leq 40\%$ – Low/ Slight

2 - 40 % $< C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO 2	3	-	-	-	-	-	-	-	-	1	-	-	2	-	-
CO 3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	1	-	-	-	-	-	-	-	1	-	-	2	-	-
CO 5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	1
CO 6	3	1	2	1	-	-	-	-	-	-	-	-	3	-	-
TOTAL	18	5	3	1	-	-	-	-	-	2	-	-	7	-	2
AVERAGE	3.0	1.25	1.5	1.0	-	-	-	-	-	1	-	-	2.3	0	1.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	✓
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**FINITE AUTOMATA**
	Fundamentals: Alphabet, strings, language, operations; Introduction to finite automata: The central concepts of automata theory, deterministic finite automata, nondeterministic finite automata, an application of finite automata, finite automata with and without epsilon transitions, Conversion of NFA to DFA, Moore and Melay Machines.
MODULE II	**REGULAR LANGUAGES**
	Regular sets, regular expressions, identity rules, constructing finite automata for a given regular expressions, conversion of finite automata to regular expressions, pumping lemma of regular sets, closure properties of regular sets (proofs not required), regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and finite automata, inter conversion.
MODULE III	**CONTEXT FREE GRAMMARS**
	Context free grammars and languages: Context free grammar, derivation trees, sentential forms, right most and leftmost derivation of strings, applications. Ambiguity in context free grammars, minimization of context free grammars, Chomsky normal form, Greibach normal form, pumping lemma for context free languages, enumeration of properties of context free language (proofs omitted)
MODULE IV	**PUSHDOWN AUTOMATA**
	Pushdown automata, definition, model, acceptance of context free language, acceptance by final state and acceptance by empty stack and its equivalence, equivalence of context free language and pushdown automata, inter conversion;(Proofs not required); Introduction to deterministic context free languages and deterministic pushdown automata.
MODULE V	**TURING MACHINE**
	Turing machine: Turing machine, definition, model, design of Turing machine, computable functions, recursivey enumerable languages, Church's hypothesis, counter machine, types of Turing machines (proofs not required), linear bounded automata and context sensitive language, Chomsky hierarchy of languages.

TEXTBOOKS

1. John E. Hopcroft , Rajeev Motwani, Jeffrey D. Ullman, —Introduction to Automata, Theory, Languages and Computation, Pearson Education, 3rd Edition, 2007.

REFERENCE BOOKS:

1. John C Martin, —Introduction to Languages and Automata Theory, Tata McGraw Hill, 3rd Edition, 2017

2. Daniel I.A. Cohen, Introduction to Computer Theory, John Wiley Sons, 2nd Edition, 2004.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106103070

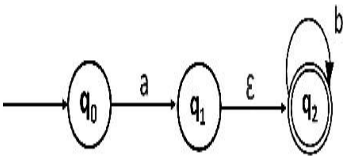
COURSE WEB PAGE:

https://lms.iare.ac.in/index?route=account/login

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO's to PO's PSO's and their attainments are discussed.		
CONTENT DELIVERY (THEORY)			
1	Alphabet, strings, language and operations	CO1	T1:1.5-1.6
2	finite automata and concepts of automata theory	CO1	T1:2.1-2.2, R2:38-64
3	Demonstrate the behavior of deterministic finite automata	CO 1	T1:2.2-2.3
4-6	Understand the functionality of non- deterministic finite automata and Finite automata with epsilon transitions.	CO 1	T1:2.3-2.4, R1:3.1-3.3, R2:142-148
7	application of finite automata,Conversion of NFA to DFA, Moore and Melay Machines.	CO 1	T1:2.3-2.4, R1:3.1-3.3, R2:142-148
8-10	understand the Regular sets, regular expressions, identity rules	CO 2	T1: 3.1-3.2
11-13	finite automata for a given regular expressions, finite automata to regular expressions	CO 2	T1: 3.1-3.2
14-15	find the pumping lemma of regular sets, regular grammars, right linear and left linear grammars	CO 3	T1: 4.1-4.2
16-19	Regular grammars-right linear and left linear grammars	CO 4	T1: 4.4-4.5
20-22	regular linear grammar and finite automata, inter conversion.	CO 2	T1: 4.4-4.5
23-24	Apply Context free grammar on derivation trees	CO 4	T1: 5.1-5.5, R1:4.2-4.4
25-27	sentential forms, right most and leftmost derivation of strings	CO 4	T1: 5.1-5.5, R1:4.2-4.4
28-29	Ambiguity in context free grammars	CO 4	T1: 5.1-5.5, R1:4.2-4.4
30-32	Understand Minimization of context free grammars, Chomsky normal form, Greibach normal form	CO 4	T1: 7.4-7.5, R1:6.1-6.2
33-34	Pumping lemma for context free languages, properties	CO 3	T1: 7.4-7.5, R1:6.1-6.2

35-37	Apply the push down automata for acceptance of context free Languages	CO 5	T1: 6.1-6.2, R1:5.2-5.4
38-41	push down automata for given context free languages	CO 5	T1: 6.1-6.2, R1:5.2-5.4
42-43	acceptance by empty stack and its Equivalence.	CO 5	T1: 6.1-6.2, R1:5.2-5.4
44-45	Describe Equivalence of context free language and pushdown automata	CO 5	T1: 6.3-6.4
46-47	inter conversion, deterministic push down automata.	CO 5	T1: 6.3-6.4
48-53	Describe Turing machine, definition, model, computable functions	CO 6	T1: 8.1-8.2, R1:7.2-7.4
54-56	Apply Recursively enumerable languages	CO 6	T1: 8.2-8.6, R1:7.5-7.6
57-58	Types of Turing machines and Church's hypothesis.	CO 6	T1: 8.2-8.6, R1:7.5-7.6
59-60	Linear bounded automata and context sensitive language.	CO 6	T1:9.1-9.8, R2:551-560
61-62	Chomsky hierarchy of languages.	CO 6	T1:9.1-9.8, R2:551-560
PROBLEM SOLVING/ CASE STUDIES			
1	Describe a DFA for the following language L={w/|w | mod5=0,w belongs to (a,b)*} L={w/|w | mod5=1,w belongs to (a,b)*}	CO 1	T1:2.3-2.4, R1:3.1-3.3
2	Convert NFA with ϵ to equivalent NFA M=({q0,q1,q2},{0,1,2}, δ, q0, {q2}) where δ is given by [δ (q0,0)={q0}, δ (q0,1)=ϕ, δ (q0,2)=ϕ, δ(q0, ϵ)=q1] [δ (q1,0)=ϕ, δ (q1,1)=q1 , δ (q1,2)=ϕ ,δ (q1, ϵ)=q2] [δ (q2,0)=ϕ, δ (q2,1)= ϕ , δ (q2,2)= {q2},δ (q2, ϵ)= ϕ]	CO1	T1:2.3-2.4, R1:3.1-3.3
3	Convert NFA with ϵ to equivalent DFA  	CO 1	T1:2.3-2.4, R1:3.1-3.3
4	Describe Pumping Lemma for Regular Languages. Prove that the language L = {a^n/ n is a n^5} is not regular	CO 3	T1: 7.4-7.5, R1:6.1-6.2
5	Convert the following automata into Regular expression M=({q1,q2,q3},{0,1}, δ, q1, {q2,q3}) where δ is given by [δ (q1,0)={q2}, δ (q1,1)={q3}] [δ (q2,0)={q1}, δ (q2,1)={q3}] [δ (q3,0)={q2}, δ (q3,1)= {q2}]	CO 2	T1: 3.1-3.2
6	Describe the DFA Transition diagram for equivalent Regular expression (ab+a) *(aa+b)	CO 1	T1:3.1-3.2
7	Convert the following grammar into GNF S→ABA/AB/BA/AA/B A→aA/a, B→bB/b	CO 4	T1: 7.4-7.5, R1:6.1-6.2
8	Describe the context free grammars in the four tuple form.(V,T,P,S) for the given languages on $\sum$={a,b} i. All strings having at least two a's ii. All possible strings not containing triple b's	CO 4	T1: 7.4-7.5, R1:6.1-6.2

9	Describe the steps to show the following is not CFG. { a$^m b^n c^p$| m< n or n< p}	CO 4	T1: 7.4-7.5, R1:6.1-6.2
10	Construct PDA for equal number of x's and y's. eg: xyyxxy	CO 5	T1: 6.1-6.2, R1:5.2-5.4
11	Construct NDPDA for L = { W$\neq$W$^R/W\in$(X + Y)*}	CO 5	T1: 6.1-6.2, R1:5.2-5.4
12	Construct DPDA for L = { W$\neq$W$^R/W\in$(X + Y)*}	CO 5	T1: 6.1-6.2, R1:5.2-5.4
13	Construct a Turing Machine that accepts the language L = {a$^{2n}b^n$|n$\geq$0}.Give the transition diagram for the Turing Machine obtained.	CO 6	T1: 8.2-8.6, R1:7.5-7.6
14	Construct a Turing Machine to accept the following languages L = { w$^n x^n y^n z^n$| n$\geq$1}	CO 6	T1:8.2-8.6, R1:7.5-7.6
15	Design a Turing Machine that accepts the language denoted by regular expression (000)*	CO 6	T1:8.2-8.6, R1:7.5-7.6
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Alphabet, strings, language and operations	CO 1	T1:1.5-1.6
2	understand the Regular sets, regular expressions, identity rules	CO 2	T1:3.1-3.2
3	Understand Minimization of context free grammars, Chomsky normal form, Greibach normal form	CO 4	T1:7.4-7.5, R1:6.1-6.2
4	push down automata for given context free languages	CO 5	T1:6.1-6.2, R1:5.2-5.4
5	Types of Turing machines and Church's hypothesis.	CO 6	T1:8.2-8.6, R1:7.5-7.6
DISCUSSION OF QUESTION BANK			
1	Describe the DFA with the set of strings having "aaa as a substring over an alphabet $\sum$ ={a,b}.	CO 1	T1:1.5-1.6
2	Convert Regular Expression (11+0)*(00+1)* to Finite Automata.	CO 2	T1:3.1-3.2
3	Describe a CFG for the languages L={a$^i b^j$| i$\leq$2j}	CO 4	T1:7.4-7.5, R1:6.1-6.2
4	Define the NPDA(Nondeterministic PDA) and DPDA(deterministic PDA) equivalent? Illustrate with an example.	CO 5	T1:6.1-6.2, R1:5.2-5.4
5	Describe a Turing Machine. With a neat diagram explain the working of a Turing Machine.	CO 6	T1: 8.2-8.6, R1:7.5-7.6

Signature of Course Coordinator **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE ENGINEERING**				
Course Title	**BUSINESS ECONOMICS AND FINANCIAL ANALYSIS**				
Course Code	AHSC13				
Program	B.Tech				
Semester	IV				
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr. S. Sivasankara Rao, Associate Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	-

II COURSE OVERVIEW:

The present course is designed in such a way that it gives an overview of concepts of Economics. Managerial Economics enables students to understand micro environment in which markets operate how price determination is done under different kinds of competitions. Financial Analysis gives clear idea about concepts, conventions and accounting procedures along with introducing students to fundamentals of ratio analysis and interpretation of financial statements. Break Even Analysis is very helpful to the Business Concern for Decision Making, controlling and forward Strategic Planning. Ratio analysis gives an idea about financial forecasting, financial planning, controlling the business and decision making.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
BEFA	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	✓	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
50%	Understand
20%	Apply
15 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

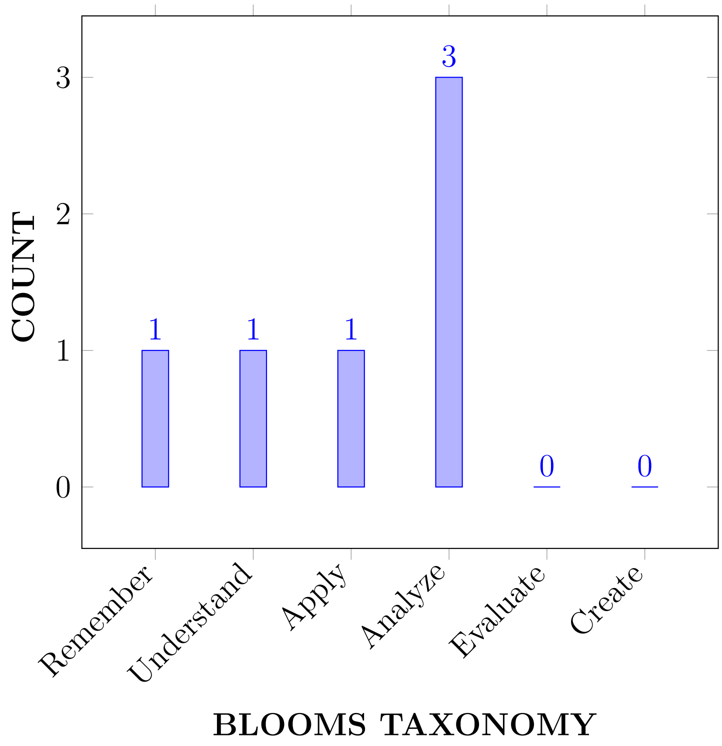
I	The concepts of business economics and demand analysis helps in optimal decision making in business environment
II	The functional relationship between Production and factors of production and able to compute breakeven point to illustrate the various uses of breakeven analysis.
III	The features, merits and demerits of different forms of business organizations existing in the modern business environment and market structures.
IV	The concept of capital budgeting and allocations of the resources through capital budgeting methods and compute simple problems for project management.
V	Various accounting concepts and different types of financial ratios for knowing financial positions of business concern.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**List** the basic concepts of managerial economics and analysis, measurement of demand and its forecasting to know the current status of goods and services.	Remember
CO 2	**Examine** to know the current status of goods and services. to know the economies and diseconomies of scale in manufacturing sector.	Analyze
CO 3	**Summarize** the four basic market models like perfect competition, monopoly, monopolistic competition, and oligopoly to know the price and quantity are determined in each model.	Understand
CO 4	**Compare** various types of business organizations and discuss their implications for resource allocation to strengthen the market environment.	Analyze
CO 5	**Analyze** different project proposals by applying capital budgeting techniques to interpret the solutions for real time problems in various business projects.	Analyze
CO 6	**Develop** the ability to use a basic accounting system along with the application of ratios to create (record, classify, and summarize) the data needed to know the financial position of the organization.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Program Outcomes	
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	1	Seminar/ Conferences
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	3	Assignments/ Discussion
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	3	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	-	-
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	-	-	-	-	-	✓	✓	-	✓	-	-	-	-
CO 2	✓	✓	-	-	-	-	-	✓	✓	-	✓	-	-	-	-
CO 3	-	-	-	-	-	-	-	✓	✓	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	✓	✓	-	-	-	-	-	-
CO 5	✓	-	-	-	-	-	-	-	-	-	✓	-	-	-	-
CO 6	-	✓	-	-	-	-	-	-	-	-	✓	-	-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	**Recall** (knowledge) the scientific fundamentals of economic activities performed by the businessmen in the business for profit earning.	2
	PO 2	**Interpret** and identify the demand and its analysis with the mathematical and natural principles of demand forecasting methods.	6
	PO 8	**Define** (knowledge) the responsibilities of the engineering practices by knowing the best economical practices.	1
	PO 9	**Match** (knowledge) the economical implication to effectively function as a team member, and as a member or leader in diverse teams.	5

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 11	**Relate** (knowledge) the knowledge and understanding of the economic principles and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	6
CO 2	PO 1	**Recall** (Knowledge) the knowledge of mathematics, science in the production function through Different Combination of variable inputs with Economies of Scale.	2
	PO 2	**Demonstrate** the different cost concepts and determine the significance of Break Even Analysis.	5
	PO 8	**Relate** (Knowledge) (Knowledge) the ethical principles and commit to professional ethics and responsibilities and norms of the production management	2
	PO 9	**Show** (Fundamentals) the production function implications for effective implementation of gang compositions in a team work and in multidisciplinary settings.	6
	PO 11	**Define** the economies of scale in production function and Break Even Analysis knowledge applied in one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	5
CO 3	PO 8	**List** (Knowledge) (Knowledge) different structures of market and how price is determined under different market structures commit to professional ethics and responsibilities and norms of the engineering practice.	2
	PO 9	**Match** the market structures and the market entry strategies as an individual, and as a member in diverse teams.	6
CO 4	PO 8	**Categorize** the ethical principles and commit to professional ethics and responsibilities belongs to different forms of business organizations existing in the modern business.	2
	PO 9	**Classify** various business organizations and their functioning as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	6
CO 5	PO 1	**Explain** the ethical issues involved in the allocation of funds under the concept of capital budgeting.	1
	PO 11	**Summarize** the concept of capital budgeting and allocations of the resources through capital budgeting methods of the management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	8
CO 6	PO 2	**Explain** the GAAP principles and ratios to analyse complex engineering problems reaching substantiated conclusions using first principles of accounts and profitability and efficiency of the organization.	6

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 11	**Illustrate**the accounting methods and procedures and accounting principles to manage the financial aspects in a project.	8

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	6	-	-	-	-	-	1	5	-	6	-	-	-	-
CO 2	2	5	-	-	-	-	-	2	6	-	5	-	-	-	-
CO 3	-	-	-	-	-	-	-	2	6	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	2	6	-	-	-	-	-	-
CO 5	1	-	-	-	-	-	-	-	-	-	8	-	-	-	-
CO 6	-	2	-	-	-	-	-	-	-	-	8	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.7	60.0	-	-	-	-	-	33.3	41.6	-	50.0	-	-	-	-
CO 2	66.7	50.0	-	-	-	-	-	66.7	50.0	-	41.6	-	-	-	-
CO 3	-	-	-	-	-	-	-	66.7	50.0	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	66.7	50.0	-	-	-	-	-	-
CO 5	33.3	-	-	-	-	-	-	-	-	-	75.0	-	-	-	-
CO 6	-	20.0	-	-	-	-	-	-	-	-	75.0	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 - $5 < C \leq 40\%$ – Low/ Slight

2 - $40\% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	-	-	-	-	-	1	2	-	2	-	-	-	-
CO 2	3	2	-	-	-	-	-	3	2	-	2	-	-	-	-
CO 3	-	-	-	-	-	-	-	3	2	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	3	2	-	-	-	-	-	-
CO 5	1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO 6	-	1	-	-	-	-	-	-	-	-	3	-	-	-	-

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
TOTAL	7	7	-	-	-	-	-	10	8	-	-	-	-	-	-
AVERAGE	2.3	2.3	-	-	-	-	-	2.5	2	-	2.5	-	-	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	PO 1, PO 2, PO 8,PO 9 PO 11	SEE Exams	PO 1, PO 2, PO 8,PO 9 PO 11	Seminars	PO8
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	PO 1, PO 2, PO 8,PO 9 PO 11	Open Ended Experiments	-
Assignments	PO 9				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

X	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION&DEMAND ANALYSIS**
	Introduction to Business Economics: Definition, Nature and Scope of Managerial Economics – Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting
MODULE II	**PRODUCTION & COST ANALYSIS**
	Theory of Production and Cost Analysis: Production Function – Iso-quants and Iso-costs, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts; Break-even analysis, Determination of Break – Even point (Simple Problems) , Managerial Significance of BEA.
MODULE III	**MARKETS & NEW ECONOMIC ENVIRONMENT**
	LMarket structures: Types of competition, Features of perfect competition, Monopoly and monopolistic competition. Price determination & Price Statistics: Price Output determination in case of perfect competition and monopoly. Features and evaluation of different forms of Business organization: Sole proprietorship, partnership, Joint Stock Company, public enterprises and their types.
MODULE IV	**CAPITAL BUDGETING**
	Capital and its significance, types of capital, estimation of fixed and working capital requirements, methods and sources of raising capital- Trading Forecast, Capital budget, Cash Budget. Features of capital budgeting proposals, methods of capital budgeting – payback method, Accounting rate of return(ARR), Net Present Value Method (simple problems).

MODULE V	INTRODUCTION TO FINANCIAL ACCOUNTING AND FINANCIAL ANALYSIS
	Financial accounting objectives, functions, importance; Accounting concepts and accounting conventions - double-entry book keeping, journal, ledger, trial balance; Final accounts: Trading account, profit and loss account and balance sheet with simple adjustments; Financial analysis: Analysis and interpretation of liquidity ratios, activity ratios, capital structure ratios and profitability ratios (simple problems), Du Pont chart.

TEXTBOOKS

1. Aryasri, “Managerial Economics and Financial Analysis”, TMH publications, 4thEdition,2012.
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10. https://caknowledge.com/how-to-prepare-final-accounts/
11. https://corporatefinanceinstitute.com/resources/knowledge/finance/ratio-analysis/

COURSE WEB PAGE:

https://lms.iare.ac.in/index?route=publicprofile&id=5201

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Discussion on Course Outcomes and how these COs mapped with POs and PSOs.		
CONTENT DELIVERY (THEORY)			
2-3	Explain about managerial economics according to the business	CO 1	T1- 1.3-1.8 R1-1.5-1.7
4-5	Describe about demand analysis, the Law of Demand and Demand Function.	CO 1	T1-2.2-2.11 R1-3.3-3.20
6-7	Understand elasticity of the demand of the product, different types, Measurement of Elasticity of Demand and Factors influencing on Elasticity of Demand.	CO 1	T1-3.3-3.20 R1- 5.29-6.8
8	State different methods of Demand Forecasting and the factors governing Demand Forecasting.	CO 1	T1-4.6-4.19
9-10	Demonstrate the Production function, features of Iso-Quants and Iso-Costs, different types of Internal Economies, External Economies and Law of Returns.	CO 2	T1- 5.3-5.18 R1- 5.29-6.8
11-13	Different types of Internal Economies, External Economies ad Law of Returns with appropriate examples.	CO 2	T1- 5.3-5.18
14-15	Illustrate different types of costs	CO 2	T1- 5.29-6.8
16-17	Explain the Significance and Limitations of Break-Even Analysis	CO 2	T1- 7.13-7.14
18-19	Calculate Break-Even Point (Simple Problems)	CO 2	T1- 7.1-7.12
20-21	Illustrate the features, price-output determination under Perfect Competition, Monopoly and Monopolistic competition Markets.	CO 3	T1- 8.4-8.16 R2- 5.29-6.8
22-24	Demonstrate the Objectives, Policies and Methods of Pricing Strategies and Price Methods.	CO 3	T1- 8.21-8.25
25-26	Describe Features of business, Definitions of Various forms of Business Units.	CO 4	T1-9.3-9.15
27-30	State the Merits & Demerits of Different types of Public Enterprises and Changing Business Environment to Post Liberalization Scenario.	CO 4	T1-9.2-10.23 R1- 8.21-8.25
31-32	Explain the significance and classification of capital, Methods and Sources of Raising Finance.	CO 6	T1-9.2-10.23
33-34	Demonstrate the concept of capital budgeting and allocations of the resources through capital budgeting methods and compute simple problems.	CO 6	T1-11.3-11.5 R2-12.3-12.5
35-37	Illustrate the Significance of Financial Accounting, Double Entry, Accounts, Accounting Concepts and Conventions	CO 6	T1-12.1-12.26
38-40	Explain the meaning, advantages and Limitations of the Journal, Ledger and Trial Balance and Final Accounts and Solve simple Problems.	CO 6	T1-13.4-13.15 R2-11.3-11.5

41-42	Describe Meaning, Definitions and Limitations of Ratio Analysis	CO 6	T1-13.4-13.15 R2-11.7-11.8
43-45	Compute different types of Financial Ratios (Problems)	CO 6	T1-13.5-13.68
PROBLEM SOLVING/ CASE STUDIES			
46	Problems relating to Demand elasticty measurement and Forecasting	CO 1	T1: 1.1 - 2.8, R1:2.1
47	Problems relation to Break Even Point	CO 2	T2: 3.0 to 3.6, 5.0 to5.5 , R2:4.4
48	Problems in determining the price in different types of markets	CO 3,4	T3: 6.0 to 6.4, R1:5.1
49	Problems relating to Capital Budgeting Decisions	CO 5	R2:7.5
50	Problems relating to Final Accounts and Calculation of Ratios	CO 6	R3: 4.1
DISCUSSION OF DEFINITION AND TERMINOLOGY			
51	Introduction and Demand Analysis	CO 1	T1: 1.1 - 2.8, R1:2.1
52	Production and Cost Analysis	CO 2	T2: 3.0 to 3.6, 5.0 to5.5 , R2:4.4
53	Markets and New Environment	CO 3,4	T3: 6.0 to 6.4, R1:5.1
54	Capital Budgeting	CO 5	R2:7.5
55	Introduciton to Financial Accounting and Financial Analysis	CO 6	R3: 4.1
DISCUSSION OF QUESTION BANK			
56	Introduction and Demand Analysis	CO 1	T1: 1.1 - 2.8, R1:2.1
57	Production and Cost Analysis	CO 2	T2: 3.0 to 3.6, 5.0 to5.5 , R2:4.4
58	Markets and New Environment	CO 3,4	T3: 6.0 to 6.4, R1:5.1
59	Capital Budgeting	CO 5	R2:7.5
60	Introduciton to Financial Accounting and Financial Analysis	CO 6	R3: 4.1

Signature of Course Coordinator **HOD,MBA**
Dr. S. Sivasankara Rao, Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Course Title	**DESIGN AND ANALYSIS OF ALGORITHMS**				
Course Code	ACSC13				
Program	B.Tech				
Semester	IV	CSE			
Course Type	Core				
Regulation	IARE - UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr.S.Sreekanth, Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB01	II	Programming for problem solving
B.Tech	ACSB03	III	Data structures

II COURSE OVERVIEW:

Design and analysis of algorithms is the process of finding the computational complexity of algorithms. It helps to design and analyze the logic on how the algorithm will work before developing the actual code for a program. It focuses on introduction to algorithm, asymptotic complexity, sorting and searching using divide and conquer, greedy method, dynamic programming, backtracking, branch and bound. NP-hard and NP-complete problems. The applications of algorithm design are used for information storage, retrieval, transportation through networks, and presentation to users.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Design and Analysis of Algorithms	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
20 %	Understand
70%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

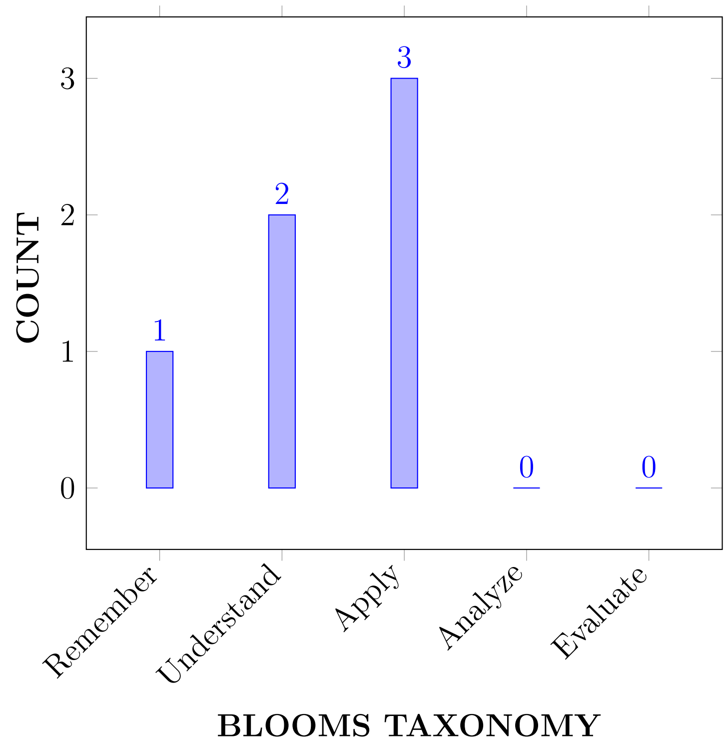
I	Mathematical approach for Analysis of Algorithms.
II	Methods and techniques for analyzing the correctness and resource requirements of algorithms.
III	Different paradigms of algorithm design including recursive algorithms, divide-and-conquer algorithms, dynamic programming, greedy algorithms, Backtracking , Branch and Bound and graph algorithms.
IV	Strategies for solving problems not solvable in polynomial time.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Find** the (worst case, randomized, amortized) running time and space complexity of given algorithms using techniques such as recurrences and properties of probability.	Remember
CO 2	**Apply** divide and conquer algorithms for solving sorting, searching and matrix multiplication.	Apply
CO 3	**Make Use of** appropriate tree traversal techniques for finding shortest path.	Understand
CO 4	**Compare** Identify suitable problem solving techniques for a given problem and finding optimized solutions using Greedy and Dynamic Programming techniques	Understand
CO 5	**Apply** greedy algorithm Utilize backtracking and branch and bound techniques to deal with traceable and in-traceable problems.	Apply
CO 6	**Apply** Describe the classes P, NP, NP-Hard, NP- complete for solving deterministic and non deterministic problems.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / Quiz / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	5	CIE / Quiz / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	CIE / Quiz / AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	4	
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	4	CIE / Quiz / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyse computer programs in the areas related to Algorithms, System Software, Web design, Bigdata, Artificial Intelligence, Machine Learning and Networking.	3	CIE / Quiz / AAT
PSO2	Focus on improving software reliability, network security or information retrieval systems.	3	CIE / Quiz / AAT
PSO3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	CIE / Quiz / AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 2	✓	✓	-	-	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 3	✓	✓	-	-	-	-	-	-	-	✓	-	✓	✓	-	-
CO 4	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	-	-
CO 5	✓	-	-	✓	-	-	-	-	-	✓	-	✓	✓	-	✓
CO 6	✓	-	-	✓	-	-	-	-	-	✓	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Analyze the running time and space complexity of given algorithms using techniques such as recurrences, potential functions, properties of probability by applying the **mathematical principles ,engineering principles and scientific principles**	3
	PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2
	PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	2
	PSO 1	Understand the basic properties of asymptotic notations, probability analysis for designing **algorithms, system software and Networking.**	4
CO 2	PO 1	Apply divide and conquer algorithms for solving sorting, searching and matrix multiplication problems to integrate **mathematical principles, engineering Principles and Scientific Principles**	3
	PO 2	Understand the given problem and develop the solution for solving sorting, searching and matrix multiplication problems and **Interpretation of results.**	4
	PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	2
	PSO 1	Build divide and conquer algorithms for solving sorting, searching, **Big data** analysis and matrix multiplication problems through **system software.**	4
CO 3	PO 1	Utilize appropriate tree traversal techniques for solving graph problems to integrate**mathematical principles and computer science methodologies**	2
	PO 2	Understand the given traversal techniques to develop the solution for graph problems and **interpretation of results.**	6
	PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2
	PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	2
CO 4	PO 1	Finding the solution of complex **engineering problems and extend the efficiencies of same problem using different algorithms in engineering disciplines.**	2
	PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2
	PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	2
	PSO 1	Make use of the concept of different algorithms for developing **intelligent systems, next generation computer systems and networking devices.**	4
CO 5	PO 1	Choose (Pick) greedy algorithms for finding solutions of minimization and maximization problems to support study of their own **engineering discipline and methodologies.**	3
	PO 2	Understand the given problem and develop the solution using greedy methods in reaching substantiated conclusions from the provided **information and interpret of results.**	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2
	PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	2
CO 6	PO 1	Apply the knowledge of dynamic programing algorithms for calculating optimized solution of complex Engineering problems by understanding **mathematical principles and computer science methodologies**	3
	PO 2	Understand the given **problem** and **choose appropriate technique** of dynamic programing algorithms for solving the given problem from the provided **Information and data** in reaching substantiated conclusions by the **interpretation of results.**	6
	PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2
	PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	2
	PSO 1	Make use of dynamic programming algorithms for higher studies in field of **machine Learning, Big data** and Understand, design and analyze computer programs in the areas related to **Algorithms**	5

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	2	-	2	3	2	1
CO 2	3	5	-	-	-	-	-	-	-	2	-	2	2	2	1
CO 3	3	5	-	-	-	-	-	-		2	-	2	2	-	-
CO 4	3	6	6	-	-	-	-	-	-	2	-	2	2	-	-
CO 5	2	-	-	2	-	-	-	-	-	2	-	2	2	-	1
CO 6	3	-	-	-	5	-	-	-	-	2	-	2	2	2	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	50	-	25	50	50	25
CO 2	100	50	-	-	-	-	-	-	-	50	-	25	50	50	25
CO 3	100	50	-	-	-	-	-	-	-	50	-	25	25	-	-
CO 4	100	60	60	-	-	-	-	-	-	50	-	25	50	-	-
CO 5	66.7	-	-	46.6	-	-	-	-	-	50	-	25	50	-	25
CO 6	100	-	-	45	-	-	-	-	-	50	-	25	50	50	25

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -5 $< C \leq 40\%$ – Low/ Slight
2 - 40 % $< C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	2	-	1	2	2	1
CO 2	3	2	-	-	-	-	-	-	-	2	-	1	2	2	1
CO 3	3	2	-	-	-	-	-	-	-	2	-	1	1	-	-
CO 4	3	3	3	-	-	-	-	-	-	2	-	1	2	-	-
CO 5	3	-	-	2	-	-	-	-	-	2	-	1	2	-	1
CO 6	3	-	-	2	-	-	-	-	-	2	-	1	2	2	1
TOTAL	18	7	3	4	-	-	-	-	-	12	-	6	11	6	4
AVERAGE	3.0	2.33	3	2	-	-	-	-	-	2.0	-	1.0	1.66	2	1

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION**
	Algorithm: Pseudo code for expressing algorithms; Performance analysis: Space complexity, time complexity; Asymptotic notations: Big O notation, omega notation, theta notation and little o notation, amortized complexity; Divide and Conquer: General method, binary search, quick sort, merge sort, Strassen's matrix multiplication.
MODULE II	**SEARCHING AND TRAVERSAL TECHNIQUES**
	Disjoint set operations, union and find algorithms; Efficient non recursive binary tree traversal algorithms, spanning trees; Graph traversals: Breadth first search, depth first search, connected components, bi-connected components.
MODULE III	**GREEDY METHOD AND DYNAMIC PROGRAMMING**
	Greedy method: The general method, job sequencing with deadlines, knapsack problem, minimum cost spanning trees, single source shortest paths. Dynamic programming: The general method, matrix chain multiplication optimal binary search trees, 0/1 knapsack problem, single source shortest paths, all pairs shortest paths problem, the travelling salesperson problem.
MODULE IV	**BACKTRACKING AND BRANCH AND BOUND**
	Backtracking: The general method, the 8 queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles; Branch and bound: The general method, 0/1 knapsack problem, least cost branch and bound solution, first in first out branch and bound solution, travelling salesperson problem.
MODULE V	**NP-HARD AND NP-COMPLETE PROBLEM**
	Basic concepts: Non-deterministic algorithms, the classes NP - Hard and NP, NP Hard problems, clique decision problem, chromatic number decision problem, Cook's theorem.

TEXTBOOKS

1. Ellis Horowitz, Satraj Sahni, Sanguthevar Rajasekharan, —Fundamentals of Computer Algorithms, Universities Press, 2nd Edition, 2015.
2. Tom White, —Hadoop: The Definitive Guide, O'Reilly, 3rd Edition, 2012.
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1. Levitin A, —Introduction to the Design and Analysis of Algorithms‖, Pearson Education, 3rd Edition, 2012.
2. Goodrich, M. T. R Tamassia, —Algorithm Design Foundations Analysis and Internet Examples‖, John Wileyn and Sons, 1st Edition, 2001.
3. Base Sara Allen Vangelder, —Computer Algorithms Introduction to Design and Analysis‖, Pearson, 3rd Edition, 1999

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Discussion on mapping COs with POs. (OBE)		
CONTENT DELIVERY (THEORY)			
2	Describe Pseudo code for expressing algorithms.	CO 1	T1:1.1,1.2
3	Summarize the concept of Space complexity, time complexity.	CO 1	T1: 1.2.7, 1.2.8
4-6	Describe Big O notation, omega notation, theta notation, little o notation and amortized complexity.	CO 1	T1:1.2.9, 1.2.11, 1.3
7-10	Use the concept of Divide and Conquer such as general method, binary search and quick sort.	CO 2	T1:1.5, 1.4.2,1.4.3
11-13	Describe the concept of merge sort, Strassen's matrix multiplication.	CO 2	T1:1.4.3, 1.4.4, 2.3.1, 2.3.2,2.3.6, 2.3.7,2.3.8
14-15	Determine disjoint set operations, union and find algorithms.	CO 3	R2:4.3 T1:2.4.1, 2.4.2,2.4.3, 4.1
16-17	Understand efficient non recursive binary tree traversal algorithms.	CO 3	T1:3.1,3.2 R1:6.2-6.8
18	Describe the concept of spanning trees with suitable examples.	CO 3	R1: 7.1-7.6
19-21	Use breadth first search and depth first search graph traversals.	CO 3	R2:8.1
22-23	Describe connected components, biconnected components.	CO 3	R2:8.2, 8.3
24-27	Understand general method of greedy method, job sequencing with deadlines, knapsack problem.	CO 4	R2: 9.1-9.3
28-29	Analyze the concept of minimum cost spanning trees, single source shortest paths.	CO 4	R2: 9.8, 9.9, 10.1, 10.2
30	Describe general method of dynamic programming, matrix chain multiplication.	CO4	T2:5.5, 5.9, 5.10
31-32	Understand optimal binary search trees, 0/1 knapsack problem, single source shortest paths.	CO 5	R2:10.4, 10.6,10.7
33-34	Define all pairs shortest paths problem, the travelling salesperson problem.	CO 5	T1:5.8-5.9
35	Discuss the concept of Backtracking, the 8 queen's problem.	CO 5	T1:7.1-7.2

36	Understand sum of subsets problem, graph coloring.	CO 5	T1:7.3-7.4
37	Summarize the concept of Hamiltonian cycles, Branch and bound.	CO 5	T1:7.5,8.1.1
38	Discuss 0/1 knapsack problem, least cost branch and bound solution.	CO 5	T1:8.2.1
39	Apply the concept of first in first out branch and bound solution, travelling salesperson problem.	CO 5	T1:8.2.2, 8.3
40	Knowledge about basic concepts of NP Hard and NP Complete, Non-deterministic algorithms.	CO 6	T1:11.1
41	Apply Working with the classes NP - Hard and NP.	CO 6	T1:11.1
42	Understand NP Hard problems, clique decision problem.	CO 6	T1:11.3
43	Implement chromatic number decision problem.	CO 6	T1:11.3
44	Cook's theorem in np hard and np complete problems.	CO 6	T1:1.1,1.2
PROBLEM SOLVING/ CASE STUDIES			
45	Discuss problems onSpace complexity, time complexity.	CO 1	T1: 1.2.7,
46	Discuss the concept of Divide and Conquer such as general method, binary search and quick sort.	CO 2	T1:1.5, 1.4.2,1.4.3
47	Describe the concept of merge sort, Strassen's matrix multiplication.	CO 2	T1:1.4.3, 1.4.4, 2.3.1, 2.3.2,2.3.6, 2.3.7,2.3.8
48	Understand efficient non recursive binary tree traversal algorithms.	CO 3	T1:3.1,3.2 R1:6.2-6.8
49	Describe the concept of spanning trees with suitable examples.	CO 3	R1: 7.1-7.6
50	Analyze the concept of minimum cost spanning trees, single source shortest paths.	CO 4	R2: 9.8, 9.9, 10.1, 10.2
51	Describe general method of dynamic programming, matrix chain multiplication.	CO4	T2:5.5, 5.9, 5.10
52	Define all pairs shortest paths problem, the travelling salesperson problem.	CO 5	T1:5.8-5.9
53	Discuss the concept of Backtracking, the 8 queen's problem.	CO 5	T1:7.1-7.2
54	Apply Working with the classes NP - Hard and NP.	CO 6	T1:11.1
DISCUSSION OF DEFINITION AND TERMINOLOGY			
55	Time and space complexity, Asymptotic notations	CO 1	T1:1.1,1.2, T1:1.2.7, 1.2.8
56	Divide and conquer Algorithms	CO 2	T1:1.5, 1.4.2,1.4.3
57	Binary traversal, BFS,DFS Algorithms	CO 3	R2:8:2

58	General method of greedy method, job sequencing with deadlines, knapsack problem,minimum cost spanning trees, single source shortest paths.	CO 4	R2: 9.1-9.3 ,R2: 9.8, 9.9
59	The concept of Hamiltonian cycles, Branch and bound, Basic concepts of Deterministic and non deterministic Problems	CO 5 and 6	T1:7.5, 8.1.1
DISCUSSION OF QUESTION BANK			
60	Questions on module-1	CO 1, 2	T1:1.1,1.2, T1:1.2.7, 1.2.8
61	Questions on module-2	CO 3	T1:3.1,3.2
62	Questions on module-3	CO4	R2: 9.8, 9.9,
63	Questions on module-4	CO5	T1:5.8-5.9
64	Questions on module-5	CO6	T1:11.1

Signature of Course Coordinator **HOD,CSE(DS)**
Dr.S.Sreekanth, Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING(CS)

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING(CS)**				
Course Title	**DATABASE MANAGEMENT SYSTEMS LABORATORY**				
Course Code	AITC07				
Program	B.Tech				
Semester	IV	CSE(CS)			
Course Type	Core				
Regulation	IARE - UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Mr Y. Manohar Reddy, Assistant Professor				

I COURSE OVERVIEW:

This Laboratory course introduces the query language for design and development of a database by using various software's such as SQL, ORACLE, and MS – Access etc. It provides practice on built-in SQL functions using languages like DDL, DCL, DML and TCL to create and manage database systems and perform Set operations, Sub Queries, Joins; and PL/SQL programs to implement Exceptions, Cursors, Stored Functions, Views, Sequences, Locks and Triggers. This is essential for mobile and web application development for business, scientific and engineering applications.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC08	III	Data Structures

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Database Management Systems Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	The SQL commands for data definition, manipulation, control and perform transactions in database systems.
II	The procedural language for implementation of functions, procedures, cursors and triggers using PL/SQL programs.

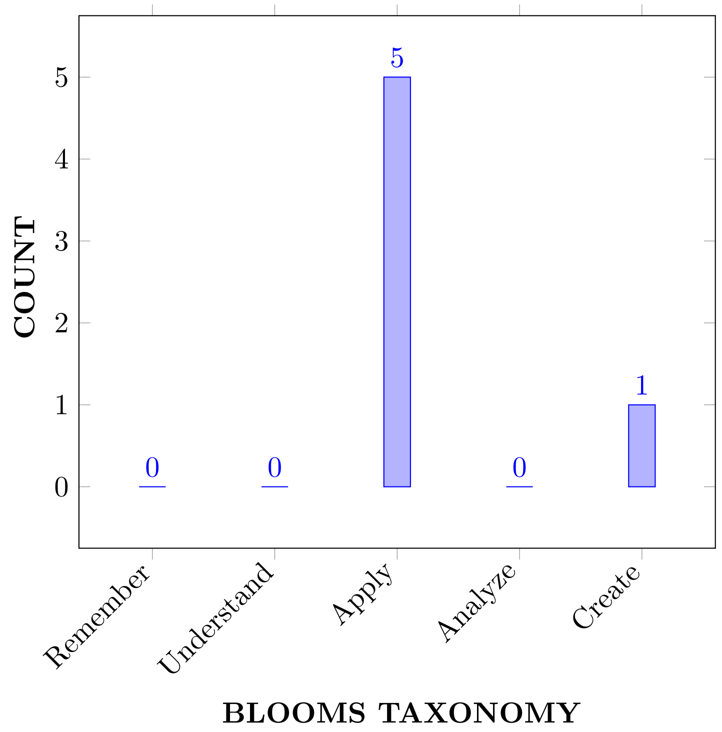
III	The logical design of a real time database system with the help of Entity Relationship diagrams.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** database creation and manipulation concepts with the help of SQL queries. .	Apply
CO 2	**Make use of** inbuilt functions of SQL queries to perform data aggregations, subqueries, embedded queries and views.	Apply
CO 3	**Apply** key constraints on database for maintaining integrity and quality of data.	Apply
CO 4	**Demonstrate** normalization by using referential key constraint.	Apply
CO 5	**Implement** PL/SQL programs on procedures, cursors and triggers for enhancing the features of database system to handle exceptions..	Apply
CO 6	**Design** database model with the help of Entity Relationship diagrams for a real time system or scenario.	Create

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 2	**Problem Analysis::** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercises,CIE,SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	CIA
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	Lab Exercises
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions..	3	Lab Exercises,CIE,SEE
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change..	2	Lab Exercises,CIE,SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 2	**Problem-Solving Skills::** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 2	Demonstrate the use of SQL for database creation and maintenance with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation	3
	PO 3	Demonstrate the use of SQL for database creation and maintenance with the help of Investigate and define a problem and identify constraints Manage the design process and evaluate outcomes,	4
	PO 5	Demonstrate the use of SQL for database creation and maintenance by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards	3
	PSO 2	**Demonstrate** the use of SQL for database creation and maintenance by using a set of instructions	1
CO 2	PO 2	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation	3
	PO 3	Demonstrate the use of SQL for database creation and maintenance with the help of Investigate and define a problem and identify constraints Manage the design process and evaluate outcomes,	4
	PO 5	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.	3
	PO 10	Build strong foundation on SQL queries for career building by communicating effectively with engineering community.,	3
	PSO 2	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation by using a set of steps.	3
CO 3	PO 2	Define the relational data model, its constraints and keys to maintain integrity of data with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation	4
	PO 10	Build strong foundation on relational model and keys for career building by communicating effectively with engineering community..	2

CO 4	PO 2	Apply normalization techniques to normalize a database with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation	4
	PO 3	Apply normalization techniques to normalize a database Investigate and define a problem and identify constraints, understand customer and user needs, Manage the design process and evaluate outcomes, Investigate and define a problem and identify constraints, understand customer and user needsManage the design process and evaluate outcomes	4
	PO 5	Apply normalization techniques to normalize a database by Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.	3
	PSO 2	Apply normalization techniques to normalize a database by using sequence of steps	1
CO 5	PO 2	Define PL/SQL programs on procedures, cursors and triggers for enhancing the features of database system to handle exceptions. with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation	4
CO 6	PO 2	Model the real-world database systems using Entity Relationship Diagrams from the requirement specification with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation	4
	PO 3	Model the real-world database systems using Entity Relationship Diagrams from the requirement specification through Investigate and define a problem and identify constraints, Understand customer and user needs, Manage the design process and evaluate outcomes.	4
	PO 5	Model the real- world database systems using Entity Relationship Diagrams from the requirement specification Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.	3
	PO 12	Build strong foundation on SQL and ER diagrams for career building by communicating effectively with engineering community.	2
	PSO 2	Model the real-world database systems using Entity Relationship Diagrams from the requirement specification by using sequence of steps	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE	PROGRAM OUTCOMES					PSO'S
OUTCOMES	PO 2	PO 3	PO 5	PO 10	PO12	PSO 2
CO 1	2	3	3			3
CO 2	2	3	3	2		3
CO 3	2			3		
CO 4	2	3	3			2
CO 5	2					
CO 6	2	3	3		2	3

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

X	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**CREATION OF TABLES**
	1. Create a table called Employee with the following structure. Name Type Emp no Number E name Varchar2(20) Job Varchar2(20) Mgr Number Sal Number • Add a column commission with domain to the Employee table • Insert any five records into the table. • Update the column details of job • Rename the column of Employ table using alter command. • Delete the employee whose empno is19. 2.Create department table with the following structure. Name Type Dept no Number Dept name Varchar2(20) location Varchar2(20) • Add column designation to the department table. • Insert values into the table. • List the records of emp table grouped by dept no. Update the record where dept no is 9. • Delete any column data from the table. 3. Create a table called Customer table Name Type Cust Name Varchar2(20) Cust city Varchar2(20) Cust city Varchar2(20) • Insert records into the table. • Add salary column to the table. • Alter the table column domain. • Drop salary column of the customer table. • Delete the rows of customer table whose cust city is hyd. 4. Create a table called branch table. Name Type Branch Name Varchar2(20) Branch city Varchar2(20) Asserts Number • Increase the size of data type for asserts to the branch. • Add and drop a column to the branch table. • Insert values to the table. • Update the branch name column • Delete any two columns from the table 5. Create a table called sailor table Name Type S Name Varchar2(20) Rating Varchar2(20) Sid Number • Add column age to the sailor table. • Insert values into the sailor table. • Delete the row with rating¿8. • Update the column details of sailor. • Insert null values into the table. 6. Create a table called reserves table. Name Type Boat Id Number Day Number Sid Number • Insert values into the reserves table. • Add column time to the reserves table. • Alter the column day data type to date. • Drop the column time in the table. • Delete the row of the table with some condition.
WEEK II	**QUERIES USING DDL AND DML**

	1. a. Create a user and grant all permissions to the user. b. Insert the any three records in the employee table and use rollback. Check the result. c. Add primary key constraint and not null constraint to the employee table. d. Insert null values to the employee table and verify the result. 2. a. Create a user and grant all permissions to the user. b. Insert values in the department table and use commit. c. Add constraints like unique and not null to the department table. d. Insert repeated values and null values into the table. 3. a. Create a user and grant all permissions to the user. b. Insert values into the table and use commit. c. Delete any three records in the department table and use rollback. d. Add constraint primary key and foreign key to the table. 4. a. Create a user and grant all permissions to the user. b. Insert records in the sailor table and use commit. c. Add save point after insertion of records and verify savepoint. d. Add constraints not null and primary key to the sailor table. 5. a. Create a user and grant all permissions to the user. b. Use revoke command to remove user permissions. c. Change password of the user created. d. Add constraint foreign key and not null. 6. a. Create a user and grant all permissions to the user. b. Update the table reserves and use savepoint and rollback. c. Add constraint primary key , foreign key and not null to the reserves table
WEEK III	**QUERIES USING AGGREGATE FUNCTIONS**

	1. a. By using the group by clause, display the enames who belongs to deptno 10 , whose salary is same as respective departments average salary. b. Display lowest paid employee details under each department. c. Display number of employees working in each department and their department number. d. Using builtin functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptname for each row, do the required thing specified above. e. List all employees which start with either B or C. f. Display only these ename of employees where the maximum salary is greater than or equal to 5000. Page 9 2. a. Calculate the average salary for each different job. b. Show the average salary of each job excluding manager. c. Show the average salary for all departments employing more than three people. d. Display employees who earn more than the lowest salary in department 30 e. Show that value returned by sign (n)function. f. How many days between day of birth to current date. 3. a. Show that two substring as single string. b. List all employee names, salary and 15c. Display lowest paid emp details under each manager d. Display the average monthly salary bill for each deptno. e. Show the average salary for all departments employing more than two people. f. By using the group by clause, display the eid who belongs to deptno 05 along with average salary. 4. a. Count the number of employees in department20 b. Find the minimum salary earned by clerk. c. Find minimum, maximum, average salary of all employees. d. List the minimum and maximum salaries for each job type. e. List the employee names in descending order. f. List the employee id, names in ascending order by empid. 5. a. Find the sids ,names of sailors who have reserved all boats called “INTERLAKE Find the age of youngest sailor who is eligible to vote for each rating level with at least two such sailors. b. Find the sname , bid and reservation date for each reservation. c. Find the ages of sailors whose name begin and end with B and has at least 3 characters. d. List in alphabetic order all sailors who have reserved red boat. e. Find the age of youngest sailor for each rating level. 6. a. List the Vendors who have delivered products within 6 months from order date. b. Display the Vendor details who have supplied both Assembled and Subparts. c. Display the Sub parts by grouping the Vendor type (Local or NonLocal). d. Display the Vendor details in ascending order.
WEEK IV	**PROGRAMS ON PL/SQL**

	1. a. Write a PL/SQL program to swap two numbers. b. Write a PL/SQL program to find the largest of three numbers. 2. a. Write a PL/SQL program to find the total and average of 6 subjects and display the grade. b. Write a PL/SQL program to find the sum of digits in a given number. Page 10 3. a. Write a PL/SQL program to display the number in reverse order. b. Write a PL / SQL program to check whether the given number is prime or not. 4. a. Write a PL/SQL program to find the factorial of a given number. b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius and area. 5. a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When hello passed to the program it should display Hll removing e and o from the world Hello). b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainder in words
WEEK V	**PROCEDURES AND FUNCTIONS**
	1. Write a function to accept employee number as parameter and return Basic +HRA together as single column. 2. Accept year as parameter and write a Function to return the total net salary spent for a given year. 3. Create a function to find the factorial of a given number and hence find NCR. 4. Write a PL/SQL block o pint prime Fibonacci series using local functions. 5. Create a procedure to find the lucky number of a given birthdate. 6. Create function to the reverse of given number.
WEEK VI	**TRIGGERS**
	1. Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values: CUSTOMERS table. 2. Creation of insert trigger, delete trigger, update trigger practice triggers using the passenger database. Passenger (Passport id INTEGER PRIMARY KEY, Name VARCHAR (50) Not NULL, Age Integer Not NULL, Sex Char, Address VARCHAR (50) Not NULL); a. Write a Insert Trigger to check the Passport id is exactly six digits or not. b. Write a trigger on passenger to display messages 1 Record is inserted, 1 record is deleted, 1 record is updated when insertion, deletion and updation are done on passenger respectively. Page 11 3. Insert row in employee table using Triggers. Every trigger is created with name any trigger have same name must be replaced by new name. These triggers can raised before insert, update or delete rows on data base. The main difference between a trigger and a stored procedure is that the former is attached to a table and is only fired when an INSERT, UPDATE or DELETE occurs. 4. Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert or update. 5. Trigger before deleting a record from emp table. Trigger will insert the row to be deleted into table called delete emp and also record user who has deleted the record and date and time of delete. 6. Create a transparent audit system for a table CUST MSTR. The system must keep track of the records that are being deleted or updated.
WEEK VII	**PROCEDURES**

	1. Create the procedure for palindrome of given number. 2. Create the procedure for GCD: Program should load two registers with two Numbers and then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is the GCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD is found. 3. Write the PL/SQL programs to create the procedure for factorial of given number. 4. Write the PL/SQL programs to create the procedure to find sum of N natural number. 5. Write the PL/SQL programs to create the procedure to find Fibonacci series. 6. Write the PL/SQL programs to create the procedure to check the given number is perfect or not.
WEEK VIII	**CURSORS**
	1. Write a PL/SQL block that will display the name, dept no, salary of fist highest paid employees. 2. Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item master table. 3. Write a PL/SQL block that will display the employee details along with salary using cursors. 4. To write a Cursor to display the list of employees who are working as a Managers or Analyst. Page 12 5. To write a Cursor to find employee with given job and deptno. 6. Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the employee table are updated. If none of the employees salary are updated we get a message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in "employee table.
WEEK IX	**CASE STUDY: BOOK PUBLISHING COMPANY**
	A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications. A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. Create the logical data model using E-R diagrams.
WEEK X	**CASE STUDY GENERAL HOSPITAL**

	A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following. 1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model using E-R diagrams.
WEEK XI	**CASE STUDY: CAR RENTAL COMPANY**
	A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes
WEEK XII	**CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM**

	A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programme have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results. For the above case study, do the following:1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model i.e., ER diagrams. 4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys wherever required. 5. Insert values into the tables created (Be vigilant about Master- Slave tables). 6. Display the Students who have taken M.Sc course. 7. Display the Module code and Number of Modules taught by each Lecturer. 8. Retrieve the Lecturer names who are not Module Leaders. 9. Display the Department name which offers "English" module. 10. Retrieve the Prerequisite Courses offered by every Department(with department names). 11. Present the Lecturer ID and Name who teaches "Mathematics. 12. Discover the number of years a Module is taught. 13. List out all the Faculties who work for Statistics Department. 14. List out the number of Modules taught by each Module Leader. 15. List out the number of Modules taught by a particular Lecturer. 16. Create a view which contains the fields of both Department and Module tables. (Hint The fields like Module code, title, credit, Department code and its name). 17. Update the credits of all the prerequisite courses to 5. Delete the Module ":History from the Module table.

TEXTBOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", Mc raw-Hill, 4th Edition,2002

2. Ivan Bayross, "SQL, PL/SQL The programming language of oracle", BPB publications, 4th Revised Edition, 2010.

REFERENCE BOOKS:

1. Ramez Elmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013

2. Peter Rob, Carles Coronel, "Database System Concepts", Cengage Learning, 7th Edition, 2008

3. M L Gillenson, "Introduction to Database Management", Wiley Student Edition,2012.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Introduction to database management system environments.	CO 1	T1:4.1, T2:1.1
2	Creation of tables using DDL and DML commands.	CO 2	T1:4.9,4.11, T2:7
3	Working with integrity constraints	CO 3	T1:3, T2:8
4	Working with DCL and TCL commands	CO 1,CO 2	T1:6.6, T2:12
5	Queries using aggregate functions.	CO 3	T1:4.4, T2:10
6	Nested queries using comparison keywords and logical operators.	CO	T1:4.6, T2:10
7	Working with Programs on pl/sql.	CO 6	T2:15
8	Working with Procedures. .	CO 3,CO 6	T2:18
9	Working with Triggers.	CO 6	R2: 5.2
10	Working with functions.	CO 5	T2:18
11	Working with Cursors. .	CO 6	T2:10
12	Case study	CO 6	T1:2, T2:1

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	**Twin vortex formation:** Implementation of views using SQL.
2	**Open channel:** Practical Implementation of assertions using PL/SQL..

Signature of Course Coordinator **HOD,CSE(CS)**
Mr.Y Manohar Reddy, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Course Title	**DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY**				
Course Code	AITB07				
Program	B.Tech				
Semester	IV	CSE			
Course Type	CORE				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Dr. K. Suvarchala, Associate Professor, CSE				

I COURSE OVERVIEW:

Design and analysis of algorithm lab provides hands on experience in implementing different algorithmic paradigms and develops competence in choosing appropriate data structure to improve efficiency of technique used. This laboratory implements sorting techniques using divide and conquer strategy, shortest distance algorithms based on Greedy, Dynamic programming techniques, Minimum spanning tree construction and applications of Back tracking , Branch and Bound. This is essential for developing software in areas Information storage and retrieval, Transportation through networks, Graph theory and Optimization problems.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	ACSB01	II	Programming for problem solving
UG	ACSB03	III	Data Structures

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Design And Analysis Of Algorithms Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

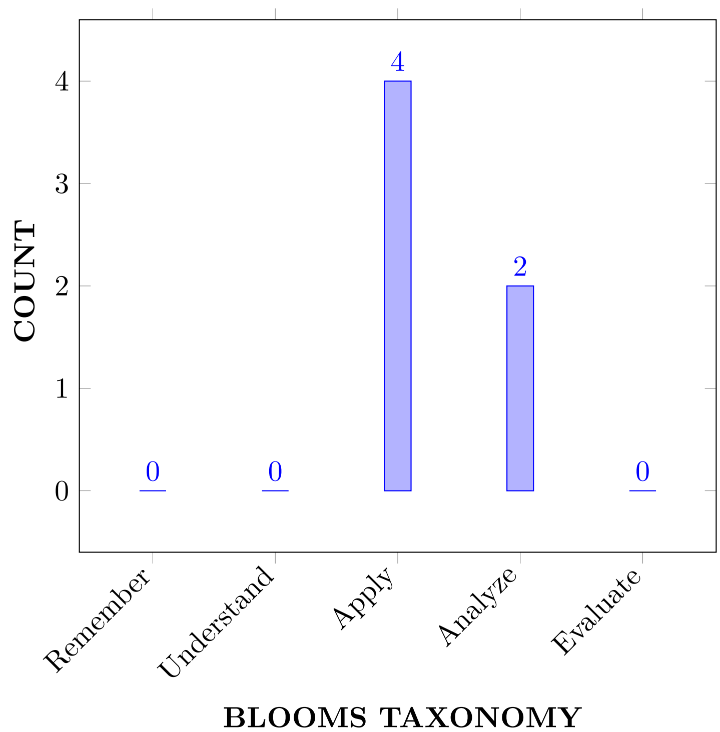
I	The selection of Algorithmic technique and Data structures required for efficient development of technical and engineering applications.
II	The algorithmic design paradigms and methods for identifying solutions of optimization problems.
III	Implementation of different algorithms for the similar problems to compare their performance.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Apply** Divide and conquer strategy to organize the data in ascending or descending order. .	Apply
CO 2	**Make use of** Algorithmic Design paradigms to determine shortest distance and transitive closure of Directed or Undirected Graphs	Apply
CO 3	**Utilize** Greedy Technique for generating minimum cost spanning tree of a Graph.	Analyze
CO 4	**Analyze** Principle of optimality in finding solutions to optimization problems.	Analyze
CO 5	**Compare** the efficiencies of traversal problems using different Tree and Graph traversal algorithms.	Apply
CO 6	**Utilize** Backtracking method for solving Puzzles involving building solutions incrementally.	Analyze
CO 7	**Examine** Branch and Bound Approach for solving Combinatorial optimization problems.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercise / CIE/SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	Lab Exercise / CIE/SEE
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	Lab Exercise / CIE/SEE
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Lab Exercise / CIE/SEE
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Lab Exercise / CIE/SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	3	Lab Exercise

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 2	**Demonstrate** the use of divide and conquer strategy for arranging data in sorted order with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and interpret the results.**	5
	PO 3	**Demonstrate** the use of sorting techniques and analyze time and space complexities with the help of **Investigate and define a problem and identify constraints Manage the design process and evaluate outcomes and use in engineering application.**	5
	PO 5	**Translate** the algorithm into python code by using its **Libraries and modules.**	1
	PSO 2	**Make use of Popular** algorithmic strategies systematically to get solution into by using its **Libraries and modules.**	2
CO 2	PO 2	**Make Use of** Dynamic programming for solving shortest distance problems with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.**	5
	PO 3	**Make Use of** Dynamic Programming for shortest distance problems and substructure generation with the help of **Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions**	5
	PO 5	**Make Use of** DP for implementing Shortest distance algorithms and optimal substructure identifications **by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	1
	PO 10	**Build** strong foundation on Dynamic Programming **for career building by communicating effectively with engineering community about optimal solutions.**	2
	PSO 2	**Demonstrate** algorithmic strategies systematically to get solution into by using its **Libraries and modules of Python**	2

CO 3	PO 2	**Make Use of** Greedy technique for solving shortest distance and MST problems with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.**	5
	PO 3	**Make Use of** Greedy technique for solving shortest distance and MST problems with **Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions.**	5
	PO 5	**Make Use of** Greedy technique for implementing MST and Graph problems by identifications **by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	1
	PSO 2	**Demonstrate** algorithmic strategies systematically to get solution into by using its **Libraries and modules of Python.**	2
CO 4	PO 2	(**Apply**) principle of Optimality for solving Optimization problems with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.**	5
	PO 3	**Apply** principle of Optimality for solving Optimization problems and substructure generation with the help of **Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions**	5
	PO 5	**Demonstrate** Principle of Optimality for implementing Shortest distance algorithms and optimal substructure identifications **by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	1
	PO 10	**Build** strong foundation on Principle of Optimality **for career building by communicating effectively with engineering community about optimal solutions.**	2
	PSO 2	**Demonstrate** Principle of Optimality systematically to get solution into by using its **Libraries and modules of Python**	2
CO 5	PO 2	**Make Use of** recursive and non recursive algorithms for comparing traversal techniques of graph and tree with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.**	5

	PO 3	**Make Use of** recursive and non recursive algorithms for comparing traversal techniques of graph and tree with with the help of **Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions.**	5
CO 6	PO 2	**Apply** Back Tracking for developing solutions to puzzles with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.**	5
	PO 2	**Apply** Back Tracking for developing solutions to puzzles with the help of **Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions**	5
	PO 5	**Apply** Back Tracking for developing solutions to puzzles with the help of **by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	1
	PO 10	**Build** strong foundation on Back tracking for **by communicating effectively with engineering community about games development.**	2
	PO 12	**Build** strong foundation on Back tracking **for career building in software development for games and puzzles**	3
CO 7	PO 2	**Make use of** Branch and Bound for solving Optimal problems with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.**	5
	PO 3	**Make use of** Branch and Bound for solving Optimal problems with the help of **Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions**	5
	PO 5	**Make use of** Branch and Bound for solving Optimal problems **by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	1
	PO 10	**Build** strong foundation on Branch and bound **for career building by communicating effectively with engineering community about optimal solutions related to state space.**	2
	PO 12	**Build** strong foundation on on Back tracking **for career building in software development for games and puzzles and optimal solutions**	3

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Table 10:

Course Outcomes	Program Outcomes					1c|Program Specific Outcomes
	PO2	PO3	PO5	P10	PO12	PSO2
CO1	5	5	1			2
CO2	5	5	1	2		2
CO3	5	5	1			2
CO4	5	5	1	2		2
CO5	5	5				
CO6	5	5	1	2	3	
CO7	5	5	1	2	3	

XII ASSESSMENT METHODOLOGY DIRECT:

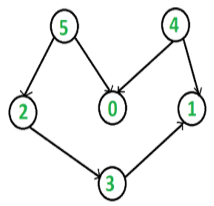
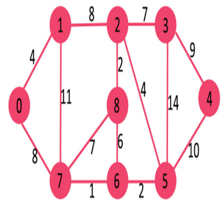
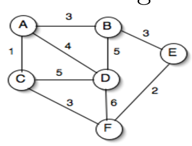
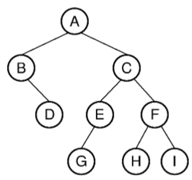
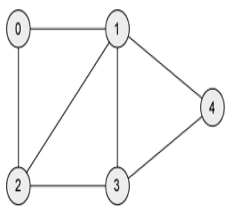
CIE Exams	PO2, PO3,PO5	SEE Exams	PO2, PO3,PO5,PO10,PO12	Seminars	-
Laboratory Practices	PO2, PO3,PO5	Student Viva	PO2, PO3,PO10	Certification	-
Assignments	-				

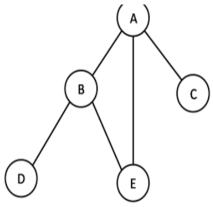
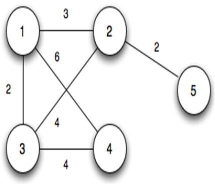
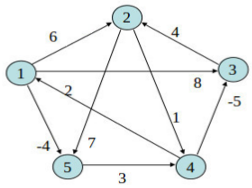
XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**QUICK SORT**
	Sort a given set of elements using the quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the 1st to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
WEEK II	**SYSTEM SPECIFICATIONS**
	Implement merge sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

WEEK III	**WARSHALL'S ALGORITHM**
	a. Obtain the Topological ordering of vertices in a given digraph. 
WEEK IV	**KNAPSACK PROBLEM**
	Implement 0/1 Knapsack problem using Dynamic Programming.
WEEK V	**SHORTEST PATHS ALGORITHM**
	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. 
WEEK VI	**MINIMUM COST SPANNING TREE**
	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm. 
WEEK VII	**TREE TRAVESRSALS**
	Perform various tree traversal algorithms for a given tree. 
WEEK VIII	**GRAPH TRAVERSALS**
	a. Print all the nodes reachable from a given starting node in a digraph using BFS method. 

<table>
<tr><td></td><td>b. Check whether a given graph is connected or not using DFS method.

</td></tr>
<tr><td>WEEK IX</td><td>SUM OF SUB SETS PROBLEM</td></tr>
<tr><td></td><td>Find a subset of a given set S = {sl, s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions{1, 2, 6} and {1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.</td></tr>
<tr><td>WEEK X</td><td>TRAVELLING SALES PERSON PROBLEM</td></tr>
<tr><td></td><td>Implement any scheme to find the optimal solution for the Traveling Sales Person problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.</td></tr>
<tr><td>WEEK XI</td><td>MINIMUM COST SPANNING TREE</td></tr>
<tr><td></td><td>Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.

</td></tr>
<tr><td>WEEK XII</td><td>ALL PAIRS SHORTEST PATHS</td></tr>
<tr><td></td><td>Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.


<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>1</td><td>0</td><td>6</td><td>8</td><td>∞</td><td>-4</td></tr>
<tr><td>2</td><td>∞</td><td>0</td><td>∞</td><td>1</td><td>7</td></tr>
<tr><td>3</td><td>∞</td><td>4</td><td>0</td><td>∞</td><td>∞</td></tr>
<tr><td>4</td><td>2</td><td>∞</td><td>-5</td><td>0</td><td>∞</td></tr>
<tr><td>5</td><td>∞</td><td>∞</td><td>∞</td><td>3</td><td>0</td></tr>
</table></td></tr>
<tr><td>WEEK XIII</td><td>N QUEENS PROBLEM</td></tr>
<tr><td></td><td>Implement N Queen's problem using Back Tracking.</td></tr>
</table>

TEXTBOOKS

1. 1. Ellis Horowitz, Satraj Sahni, Sanguthevar Rajasekharan, Fundamentals of Computer Algorithms, Universities Press, 2nd Edition, 2015.

2. 2. Alfred V. Aho, John E. Hopcroft, Jeffrey D, The Design And Analysis Of Computer Algorithms, Pearson India, 1st Edition, 2013.

REFERENCE BOOKS:

1. 1. Levitin A, Introduction to the Design and Analysis of Algorithms‖, Pearson Education, 3rd Edition, 2012.

2. 2. Goodrich, M. T. R Tamassia, Algorithm Design Foundations Analysis and Internet Examples‖, John Wileyn and Sons, 1st Edition, 2001.

3. 3. Base Sara Allen Vangelder, Computer Algorithms Introduction to Design and Analysis‖, Pearson, 3rd Edition, 1999.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Quick Sort	CO 1	T1:4.1, T2:1.1
2	Merge Sort	CO 1	T1:4.9,4.11, T2:7
3	Warshalls Algorithm	CO 2	T1:3, T2:8
4	Knap Sack Problems	CO 4	T1:6.6, T2:12
5	Shortest distance using Dijkstra's algorithm	CO3	T1:4.4, T2:10
6	Minimum spanning tree using Kruskal's algorithm	CO3	T1:4.6, T2:10
7	Tree Traversal Techniques using Non recursive techniques	CO 5	T2:15
8	Graph Traversal Techniques	CO 5	T2:18
9	Sum of Subsets using DP	CO 4	T2:18
10	Travelling salesman Problem	CO4	T2:18
11	Minimum spanning tree using Prims algorithm	CO3	T2:10
12	All Pairs Shortest Paths – Floyd Algorithms	CO7	T1:2, T2:1
13	N Queen Problem	CO6	T1:2, T2:1

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Implementation of Optimization problems using Branch and Bound.
2	Practical Implementation of Games and Puzzles using Back Tracking

Signature of Course Coordinator **HOD,CSE**
Dr K Suvarchala, Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Course Title	**LINUX PROGRAMMING LABORATORY**				
Course Code	ACSC16				
Program	B.Tech				
Semester	IV	CSE(DS)			
Course Type	Core				
Regulation	IARE - UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	2	2
Course Coordinator	Dr.M.Lakshmi Prasad, Associate Professor				

I COURSE OVERVIEW:

This course covers operating system concepts in linux environment. It focuses on practice on shell commands and demonstration of process concepts such as creation and establishing communication using linux system calls. The main objective of the course is to teach the students how to work with linux environment and demonstration of operating systems concepts using linux system calls in C programs. This course reaches to student by power point presentations, lecture notes, and lab which involve the problem solving in mathematical and engineering areas. .

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC04	II	Programming for Problem Solving

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
LINUX PROGRAMMING LABORATORY	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

X	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

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	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

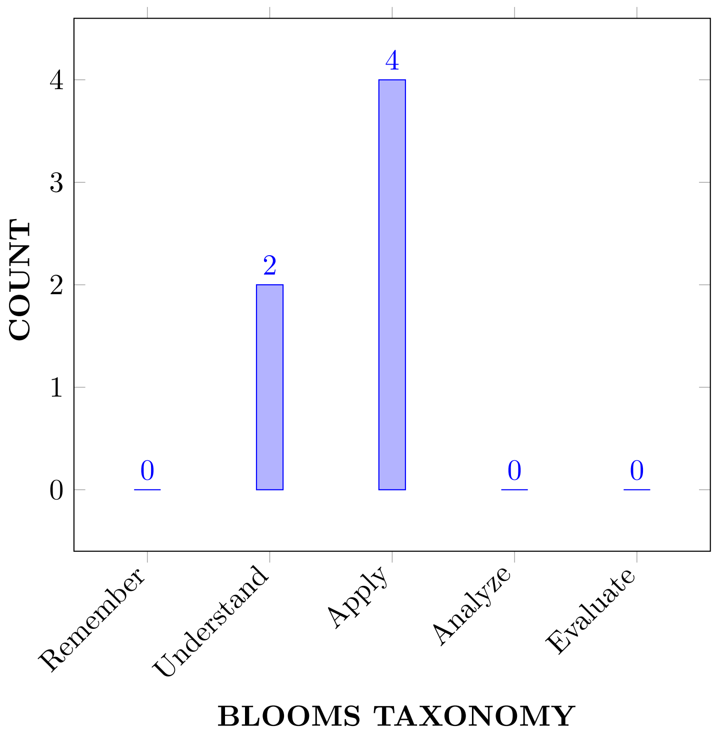
I	Familiar with the Linux command-line environment.
II	Understand system administration processes by providing a hands-on experience.
III	Understand Process management and inter-process communications techniques.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** text processing utilities, file handling utilities, security by file permissions, process utilities, disk utilities and networking commands with different options available for solving problems.	Understand
CO 2	**Make use of** bourne shell constructs, decision structures and loops in designing programs for complex problems.	Apply
CO 3	**Interpret** to write, compile, debug and run C language program in linux shell environment for implementing kernel level concepts.	Understand
CO 4	**Identify** basic methods and techniques used in solving simple programming tasks in the area of execution environment, processes signals and threads.	Apply
CO5	**Experiment with** IPC mechanisms such as pipes, named pipes, shared memory, message queues, semaphores and sockets for interprocess communication.	Apply
CO 6	**Choose** the appropriate protocol such as TCP or UDP for effective communication in client-server applications.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / SEE/ Lab Exercises
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE / SEE/ Lab Exercises
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE / SEE/ Lab Exercises
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	CIE / SEE/ Lab Exercises
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	CIE / SEE/ Lab Exercises

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2	Lab Exercises
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	Lab Exercises
PSO 3	Practical experience in shipping real wor software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	2	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Demonstrate shell commands for creating and searching files in **engineering fundamentals**, and an **engineering specialization** to the solution of **complex engineering problems.**	3
CO 2	PO 1	Make use of the following bourne shell constructs: test, if then, if then else, if then elif, for, while, until, and case to find the solution of **complex engineering problems.**	1
CO 3	PO 1	Interpret to write, compile, debug and run C language program in linux shell environment to apply the knowledge of **engineering fundamentals**, and an **engineering specialization** to the solution of **complex engineering problems**.	3
	PO 3	Interpret to write, compile, debug and run C language program in linux shell environment for designing solutions for **complex engineering problems**.	1
CO 4	PO 1	Identify basic methods and techniques used in solving simple programming tasks in the area of execution environment, processes and signals, threads and asynchronous I/O using **engineering fundamentals** for the solutions of **complex engineering problems**.	2
CO 5	PO 1	Apply the knowledge of IPC mechanisms for inter process communication in **engineering fundamentals**, and an **engineering specialization** to the solution of **complex engineering problems**.	3
	PO 2	Experiment with IPC mechanisms for inter process communication to analyze **complex engineering problems** reaching **substantiated conclusions** using **principles of engineering sciences**.	3
	PSO 1	Design **next-generation computer systems, networking devices** using IPC mechanisms for inter process communication..	2
CO 6	PO 1	Find the effective solution of **complex engineering problems** by choosing the appropriate protocol for effective communication in client-server applications.	1
	PSO 2	Focus on **web applications development** and learn the **emerging technologies** for effective communication in client-server applications.	2

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES				PROGRAM OUTCOMES		
	PO 1	PO 2	PO 3	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3						
CO 2	1						
CO 3	3		1				
CO 4	2						
CO 5	3	3			2		
CO 6	1					2	

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1, PO 2, PO 3	SEE Exams	PO 1,PO 2, PO 3	Seminars	-
Laboratory Practices	PO 1,PO 2, PO 3	Student Viva	PO 1, PO 2, PO 3	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK 1	**BASIC COMMANDS I**
	Study and Practice on various commands like man, passwd, tty, script, clear, date, cal, cp, mv, ln, rm, unlink, mkdir, rmdir, du, df, mount, umount, find, unmask, ulimit, ps, who, w.
WEEK 2	**BASIC COMMANDS II**
	Study and Practice on various commands like cat, tail, head , sort, nl, uniq, grep, egrep,fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, tar, cpio.
WEEK 3	**SHELL PROGRAMMING I**
	a) Write a Shell Program to print all .txt files and .c files. b) Write a Shell program to move a set of files to a specified directory. c) Write a Shell program to display all the users who are currently logged in after a specified time. d) Write a Shell Program to wish the user based on the login time.
WEEK 4	**SHELL PROGRAMMING II**

	a) Write a Shell program to pass a message to a group of members, individual member and all. b) Write a Shell program to count the number of words in a file. c) Write a Shell program to calculate the factorial of a given number. d) Write a Shell program to generate Fibonacci series.
WEEK 5	**SIMULATING COMMANDS I**
	a) Simulate cat command b) Simulate cp command
WEEK 6	**SIMULATING COMMANDS II**
	a) Simulate tail command b) Simulate head command
WEEK 7	**SIMULATING COMMANDS III**
	a) Simulate mv command b) Simulate nl command
WEEK 8	**SIGNAL HANDLING**
	Write a program to handle the signals like SIGINT, SIGDFL, SIGIGN
WEEK 9	**INTERPROCESS COMMUNICATIONS**
	Implement the following IPC forms a) FIFO b) PIPE
WEEK 10	**MESSAGE QUEUES**
	a) Write a C program(sender.c) to create a message queue with read and write permissions to write 3 messages to it with different priority numbers. b) Write a C program(receiver.c) that receives the messages (from the above message queue as specified and displays them.
WEEK 11	**SHARED MEMORY**
	Implement shared memory form of IPC.
WEEK 12	**SOCKET PROGRAMMING**
	a) Write client and server programs (using c) for interaction between server and client processes using TCP elementary functions. b) Write client and server programs (using c) for interaction between server and client processes using UDP elementary functions.

TEXTBOOKS

1. Sumitabha Das, “Your Unix The Ultimate Guide”, Tata McGraw-Hill, New Delhi, India, 2007.

2. B. A. Forouzan and R. F. Gilberg, “Unix and Shell Programming”, Cengage Learning.

REFERENCE BOOKS:

1. Robert Love, “Linux System Programming”, O’Reilly, SPD.

2. Stephen G. Kochan, Patrick Wood, “Unix Shell Programming”, Sams publications, 3rd Edition, 2007.

3. T. Chan, “Unix System Programming using C++”, Prentice Hall India, 1999

Web References:

1. http://spoken-tutorial.org/tutorialsearch/?search_foss=Linux&search_language=English

2. https://www.redhat.com/en/files/resources/en-rhel-whats-new-in-rhel-712030417.pdf

3. http:// www.tutorialspoint.com/unix/ 4. http://cse09-iiith.virtual-labs.ac.in

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Basic Commands I	CO 1	T2: 4.7-4.8, 5.3-5.4
2	Basic Commands II.	CO 1	T2: 4.7-4.8, 5.3-5.4
3	Shell Programming I	CO 2	T2: 8.5, 14.14
4	Shell Programming II	CO 2	T2: 8.5, 14.14
5	Simulating Commands I	CO 3	T2: 12.3-12.9, 15.9-15.10
6	Simulating Commands II	CO 3	T2: 3.10,15.6, 17.5-17.6
7	Simulating Commands III	CO 3	T2: 3.10,15.6, 17.5-17.6
8	Signal Handling	CO 4	R4: 10.4-10.19
9	Inter process Communications.	CO 5	R4: 14.1-14.5
10	Message Queues	CO 5	R4: 14.1-14.5
11	Shared Memory	CO 5	R4: 14.7
12	Socket Programming	CO 5,CO 6	R2: 15.5

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Write a C program to create a child process and allow the parent to display parent and the child to display child on the screen.
2	Write a C program to create a Zombie process.
3	Write a Shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
4	Write a C Program that makes a copy of a file using standard I/O and system calls.
5	Write a C program in which a parent writes a message to a pipe and the child reads the message.
6	Write a C program that illustrates how an orphan is created.

Signature of Course Coordinator **HOD,CSE(DS)**
Dr.M.Lakshmi Prasad, Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**COMPUTER NETWORKS**				
Course Code	AITC06				
Program	B.Tech				
Semester	V				
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Ms. BK Aishwarya , Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB07	III	Computer Organization and Architecture

II COURSE OVERVIEW:

The main emphasis of this course is on the organization and management of local area networks (LANs) wide area networks (WANs). The course includes learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks. Topics include layered network architectures, addressing, naming, forwarding, routing, communication reliability, the client-server model, and web and email protocols. The applications of this course are to design, implement and maintain a basic computer networks.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Computer Networks	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
50 %	Understand
30 %	Analyze
20 %	Evaluate

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

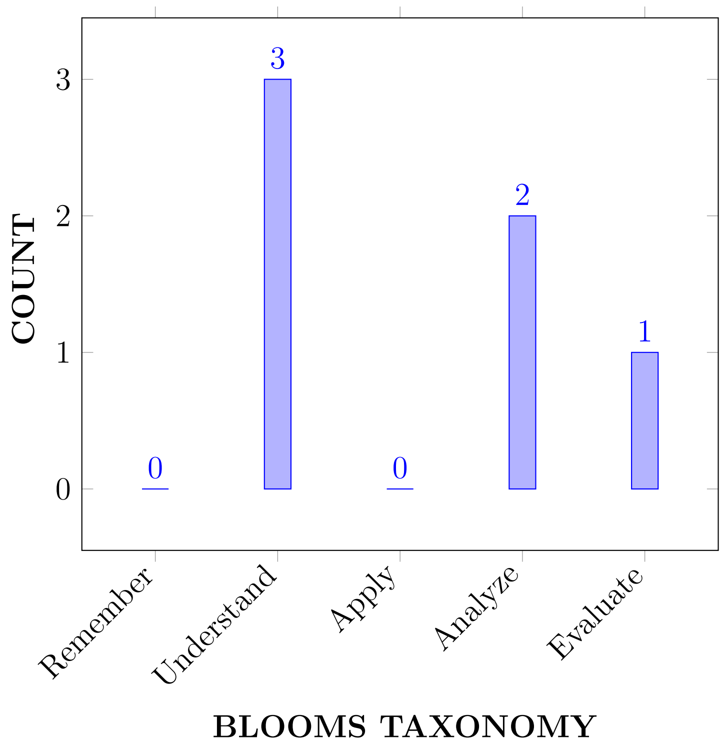
I	How computer network hardware and software operate
II	Investigate the fundamental issues driving network design
III	The data transmission through protocols across the network in wired and wireless using routing algorithms.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Outline** the basic concepts of data communications including the key aspects of networking and their interrelationship, packet, circuit and cell switching as internal and external operations, physical structures, types, models, and internetworking	Understand
CO 2	**Make use of** different types of of bit errors and the concept of bit redundancy for error detection and error correction.	Understand
CO 3	**Identify** the suitable design parameters and algorithms for assuring quality of service and internetworking in various internet protocols	Understand
CO 4	**Interpret** transport protocols (TCP,UDP) for measuring the network performance	Evaluate
CO 5	**Illustrate** the various protocols (FTP, SMTP,TELNET, EMAIL,WWW) and standards (DNS) in data communications among network.	Analyze
CO 6	**Compare** various networking models (OSI, TCP/IP) in terms of design parameters and communication modes.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE/Quiz/AAT
PO 10	**Communication:** Communicate effectively on complex Engineering activities with the Engineering .community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions..	2	Discussion on Innovations / Presentation
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	Short term courses

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2	Research papers / Group discussion / Short term courses
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	1	Research papers / Industry exposure

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	✓	-	✓	-	-	-
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 4	✓	-	✓	✓	-	-	-	-	-	✓	-		✓	-	✓
CO 5	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	-	✓
CO 6	✓	-	✓	-	-	-	-	-	-	-	-		-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Understand the importance of network types, suitable transmission medium, devices and the Internet in supporting business communications and everyday activities by understanding **fundamentals of Computer engineering specialization** and **scientific principles.**	1
CO 2	PO 1	Understand the importance of network types, suitable transmission medium, devices and the Internet in supporting business communications and everyday activities by understanding **fundamentals of Computer engineering specialization** and **scientific principles.**	2
	PO 2	Understand the **problem** statement and **choose appropriate techniques** by **analyzing** the importance of data hiding **interpretation of results.**	4
	PO 10	Recognize the importance of error detection and correction techniques for optimizing the efficiency of the networks by **communicating effectively** with **engineering community.**	2
	PO 12	Build strong foundation of the performance of a single link, logical process-to-process (end-to-end) channel, and a network as a whole (latency, bandwidth, and throughput) for career **building** by **communicating effectively** with **engineering community.**	4
CO 3	PO 1	Explain the concept of Hamming distance, and the significance of the minimum Hamming Distance and its relationship to errors by **understanding mathematical principles** and **scientific principles.**	3
	PO 2	Understand the **problem** statement and **choose appropriate techniques** by **analyzing**the importance of data hiding **interpretation of results.**	4
	PO 3	**Understand the concepts** E-mail, telnet, secure shell for **innovative solutions, evaluate the solution of the complex issues.**	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	Recognize the importance of error detection and correction techniques for optimizing the efficiency of the networks by **communicating effectively** with **engineering community.**	2
	PSO 1	Design **next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers,** and **knowledge discovery tools.**	6
CO 4	PO 1	Describe the relationship between data and signals, their types, behavior, properties, characterization and transmission through the physical layer by **understanding mathematical principles** and **scientific principles.**	2
	PO 3	**Understand the concepts** E-mail, telnet, secure shell for **innovative solutions, evaluate the solution of the complex issues.**	3
	PO 4	Evaluate the performance of a single link, logical process-to-process (end-to-end) channel, a and **a network as a whole (latency, bandwidth, and throughput).**	2
	PO 10	Recognize the importance of error detection and correction techniques for optimizing the efficiency of the networks by **communicating effectively with engineering community.**	2
	PSO 1	Design **next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers,** and **knowledge discovery tools.**	6
	PSO 3	Practical experience in **shipping real world software,using industry standard tools** and **collaboration techniques** will equip to secure and succeed in first job upon graduation in IT industry.	3
CO 5	PO 1	Understand the basic design problems of data communications including the checksum, flow control, error control, reliability by apply the **knowledge of computer engineering fundamentals and mathematical principles.**	2
	PO 2	Understand the **problem** statement and **choose appropriate techniques by analyzing**analyzing the importance of data hiding **interpretation of results.**	3
	PO 3	**Understand the concepts** E-mail, telnet, secure shell for **innovative solutions, evaluate the solution of the complex issues.**	3
	PO 12	Build strong foundation of the performance of a single link, logical process-to-process (end-to-end) channel, and a network as a whole (latency, bandwidth, and throughput) for career **building by communicating effectively with engineering community.**	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 1	Design **next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers**, and **knowledge discovery tools.**	6
	PSO 3	Practical experience in **shipping real world software,using industry standard tools** and **collaboration techniques** will equip to secure and succeed in first job upon graduation in IT industry.	3
CO 6	PO 1	Describe the reliable inter-node transmission of chunks and congestion control methods for reliable data transmission across the network by apply the**knowledge of computer engineering fundamentals and mathematical principles.**	2
	PO 3	**Understand the concepts** E-mail, telnet, secure shell for **innovative solutions, evaluate the solution of the complex issues.**	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	2	4	-	-	-	-	-	-	-	2	-	4	-	-	-
CO 3	3	4	3	-	-	-	-	-	-	2	-	-	6	-	-
CO 4	2	-	3	2	-	-	-	-	-	2	-	-	6	-	3
CO 5	2	3	3	-	-	-	-	-	-	-	-	2	6	-	3
CO 6	2	-	3	-	-	-	-	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	33.3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	66.7	40	-	-	-	-	-	-	-	40	-	33.3	-	-	-
CO 3	100	40	30	-	-	-	-	-	-	40	-	-	100	-	-
CO 4	66.7	-	30	18	-	-	-	-	-	40	-	-	100	100	-
CO 5	66.7	30	30	-	-	-	-	-	-	-	-	17	100	100	-
CO 6	66.7	30	-	-	-	-	-	-	-	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 - $5 < C \leq 40\%$ – Low/ Slight

2 - 40 % <C < 60% –Moderate
3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	-	-	-	-	-	-	-	2	-	1	-	-	-
CO 3	3	2	1	-	-	-	-	-	-	1	-	-	3	-	-
CO 4	3	-	1	1	-	-	-	-	-	1	-	-	3	3	-
CO 5	3	1	1	-	-	-	-	-	-	-	-	1	3	-	3
CO 6	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	15	5	4	1	-	-	-	-	-	4	-	2	9	3	3
AVERAGE	2.5	1.6	1.3	1.0	-	-	-	-	-	1.3	-	1.0	3.0	1.0	1.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	✓
Assignments	✓				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

X	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION**
	Introduction: Networks, network types, internet history, standards and administration; Network models: Protocol layering, TCP/IP protocol suite, the OSI model Transmission media: Introduction, guided media, unguided media; Switching: Introduction, circuit switched networks, packet switching.
MODULE II	**DATA LINK LAYER**
	Introduction: Link layer addressing; Error detection and correction: Cyclic codes, checksum, forward error correction; Data link control: DLC services, data link layer protocols, media access control: Random access, virtual LAN.
MODULE III	**NETWORK LAYER**
	Network layer design issues, routing algorithms, congestion control algorithms, quality of service, and internetworking. The network layer in the internet: IPv4 addresses, IPv6, internet control protocols, OSPF(Open Shortest Path First), IP (Internet Protocol)

MODULE IV	**TRANSPORT LAYER**
	The transport service, elements of transport protocols, congestion control; The internet transport protocols: UDP (User Datagram Protocol), TCP (Transport Control Protocol), performance problems in computer networks, network performance measurement.
MODULE V	**APPLICATION LAYER**
	Introduction, client server programming, WWW (World Wide Web) and HTTP (Hyper Text Transfer Protocol), FTP (File Transfer Protocol), E-mail, telnet, DNS (Domain Naming System), SNMP (Simple Network Management Protocol).

TEXTBOOKS

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, 5th Edition, 2012.
2. Andrew S. Tanenbaum, David.j.Wetherall, "Computer Networks", Prentice-Hall, 5th Edition, 2010.

REFERENCE BOOKS:

1. Douglas E. Comer, "Internetworking with TCP/IP", Prentice-Hall, 5th Edition, 2011
2. Peterson, Davie, Elsevier, "Computer Networks", 5th Edition,2011
3. Comer, "Computer Networks and Internets with Internet Applications", 4th Edition, 2004.
4. Chwan-Hwa Wu, Irwin, "Introduction to Computer Networks and Cyber Security", CRC publications, 2014.

WEB REFERENCES:

1. https://www.geeksforgeeks.org/computer-network-tutorials/

COURSE WEB PAGE:

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
1	Introduction: Networks, network types	CO1	T1: 1.1
2	Internet history	CO1	T1:1.2
3	Standards and administration	CO1	T1: 1.3
4	Network models: Protocol layering	CO1	T1:1.4
5	TCP/IP protocol suite	CO1	T1: 1.5

6	The OSI model Transmission media: guided media, unguided media	CO1	T1:7.1
7	Switching	CO1	T1: 2.14
8	Circuit switched networks	CO1	T1: 8.1
9	Packet switching	CO1	T1: 8.2
10	Link layer addressing	CO2	T1: 10.0
11	Error detection and correction	CO2	T1: 10.1
12	Cyclic codes	CO2	T1: 10.1
13	Checksum	CO2	T1: 10.2
14	Forward error correction	CO2	T1: 10.2
15	Data link control: DLC services	CO2	T1: 11.1
16	Data link layer protocols	CO2	T1: 11.2
17	Media access control: Random access	CO2	T1: 11.3
18	Virtual LAN	CO2	T1:15.3
19	Network layer design issues	CO3	T1:19.1
20	Routing algorithms	CO3	T1: T1:19.1
21	Congestion control algorithms	CO3	T1:19.1
22	Quality of service and Internetworking	CO3	T1:19.1
23	The network layer in the internet: IPv4 addresses	CO3	T1:19.1
24	IPv6, internet control protocols	CO3	T1:19.2
25	OSPF (Open Shortest Path First)	CO3	T1:19.2
26	IP (Internet Protocol)	CO4	T1:19.1
27	The transport service	CO4	T1:23.0
28	Elements of transport protocols	CO4	T1:23.1
29	Congestion control	CO4	T1:23.1
30	The internet transport protocols: UDP (User Datagram Protocol)	CO4	T1:23.2
31	TCP (Transport Control Protocol)	CO4	T1:23.3
32	Performance problems in computer networks	CO4	T1:23.3
33	Network performance measurement	CO4	T1:23.3
34	Client server programming	CO5	T1:25.1
35	WWW (World Wide Web)	CO5	T1:25.2
36	HTTP (Hyper Text Transfer Protocol)	CO5	T1:25.3
37	FTP (File Transfer Protocol)	CO5	T1:25.4
38	E-mail, telnet	CO5	T1:25.5
39	DNS (Domain Naming System)	CO5	T1:25.6
40	SNMP (Simple Network Management Protocol)	CO5	T1:25.7
PROBLEM SOLVING/ CASE STUDIES			
41	With a network with bandwidth of 10 Mbps can pass only an average of 12,000 frames per minute with each frame carrying an average of 10,000 bits. What is the throughput of this network?	CO 1	T2:18.3.4, 18.3, 4.17

42	Demonstrate the Laplace transform of the message delay in FDMA in which every message contains a random number of packets. Compare the expected message delay with that of TDMA	CO 2	T2:24.2,28.4
43	Why are we running out of IPv4 addresses? How does IPv6 solve this problem?	CO 3	T1: 276-296
44	Discuss in detail about the connection establishment and release in TCP.	CO 4	T2:24.3.6, 24.3.9
45	Discuss about application layer and client server programming	CO 5	T2:25.1, 25.1.2
46	Interpret the following sequences of characters (In Hexadecimals) received by a TELNET client or server. a. FFFB01 c. FFF4 FFFE01 d. FFF9	CO 5	T2:26.1.2, 26.2, 26.3, 26.4,26.5
DEFINITION AND TERMINOLOGY			
1	What is Computer Network?	CO 1	T2:2.1
2	Define Unacknowledged Information Transfer Service?	CO 2	T2:2.3
3	Define routing algorithm?	CO 3	T2:2.3.1
4	What is Secure Sockets Layer?	CO 4	T2:7.2,7.3
5	Define Network File system (NFS)?	CO 5	T2:10.3.1
DISCUSSION OF QUESTION BANK			
1	Illustrate the differences between the OSI and TCP/IP Reference Models.	CO 1	T2:2.1
2	Recognize knowledge on previous versions of internet	CO 2	T2:2.3
3	Understands on the various standards and administrations	CO 3	T2:2.3.1
4	Discuss on networks models and understand layering scenarios and protocols	CO 4	T2:7.2,7.3
5	Demonstrate on TCP/IP models	CO 5	T2:10.3.1
6	Demonstrate on Guided and Unguided medium.	CO 5	T2:13.3.2, 13.4.1

Signature of Course Coordinator **HOD,CSE**
Ms. BK Aishwarya, , Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**					
Course Title	**COMPILER DESIGN**					
Course Code	ACSC40					
Program	B.Tech					
Semester	V					
Course Type	Core					
Regulation	UG20					
Course Structure	Theory			Practical		
	Lecture	Tutorials	Credits	Laboratory	Credits	
	3	1	4	-	-	
Course Coordinator	Ms. N M Deepika , Assistant Professor					

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	ACS01	I	Computer Programming
UG	ACS02	II	Data Structures
UG	AHS013	III	Discrete Mathematical Structures
UG	AIT002	IV	Theory of Computation

II COURSE OVERVIEW:

This course describes the basic techniques for compiler construction and tools that can be used to perform syntax-directed translation of a high-level programming language into an executable code. It will provide deeper insights into the more advanced semantics aspects of programming languages, machine independent optimizations and code generation.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Compiler Design	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

x	Chalk & Talk	✓	Quiz	✓	Assignments	x	MOOCs
✓	PPT	✓	Seminars	x	Mini Project	✓	Videos
x	open Ended Experiments						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
40 %	Understand
50 %	Apply
0 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

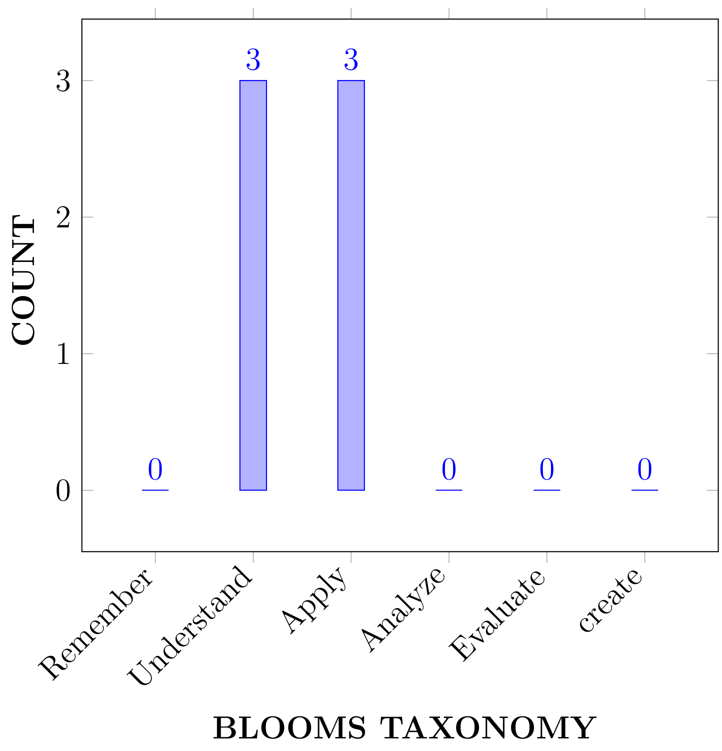
I	The process of translating a high-level language to machine code required for compiler construction.
II	The Software tools and techniques used in compiler construction such as lexical analyser and parser generators.
III	The data structures used in compiler construction such as abstract syntax trees, symbol tables, three-address code, and stack machines.
IV	The deeper insights into the syntax and semantic aspects of programming languages, dynamic memory allocation and code generation.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Summarize** phases of a compiler in the construction of language processors.	Understand
CO 2	**Make use of** finite automata for designing a lexical analyzer for a specific programming language constructs.	Apply
CO 3	**Choose** top down, bottom up parsing methods for developing a parser with representation of a parse table or tree.	Apply
CO 4	**Outline** syntax directed translations, intermediate forms for performing semantic analysis along with code generation.	Understand
CO 5	**Relate** symbol table, type checking and storage allocation strategies used in run-time environment.	Understand
CO 6	**Select** code optimization techniques on intermediate code form for generating target code.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Program Outcomes	
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / Quiz / AAT
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	CIE / Quiz / AAT
PO 3	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	CIE / Quiz / AAT
PO 5	Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	2	CIE / Quiz / AAT

PO 10	Communication: Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	CIE / Quiz / AAT/Tech-Talk

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		**Strength**	**Proficiency Assessed by**
PSO 1	Understand, design and analyse computer programs in the areas related to Algorithms, System Software, Web design, Bigdata, Artificial Intelligence, Machine Learning and Networking.	2	Group discussion/ Short term courses
PSO 2	Focus on improving software reliability, network security and information retrieval systems.	3	Industry exposure/AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	Group discussion/ Short term courses/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**												**PSO'S**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	-	-
CO 2	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-
CO 4	✓	-	✓	-	✓	-	-	-	-	-	-	-	-	-	-
CO 5	-	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	✓	✓	-	-	✓	-	-	-	-	✓	-	-	-	-	✓

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	**Justification for mapping (Students will be able to)**	No. of Key Competencies
CO 1	PO 1	Describe the role of lexical analyzer and recognition of tokens, from regular expressions to finite automataby applying engineering fundamentals and provide solutions to engineering problems.	2
	PO 5	Understand the phases of compiler in optimizing regular Expressions by using the mathematical principles and computer science methodologies.	1
	PSO 1	Understand pass and phases of translation for specific problems with lexical analyzer generator.	1
CO2	PO 1	Understand the significant phases of translation, bootstrapping, LEX-lexical analyzer generator in lexical analysis using mathematical principles, fundamental of Computer engineering specialization and scientific principles.	3
	PSO 1	Understand the finite automata, regular Expressions in the area related to lexical analysis.	1
CO 3	PO 1	Understand the different types of parsing methods including the backtracking by apply the knowledge of computer engineering fundamentals and mathematical principles	2
	PO 2	Understand the problem statement and choose appropriate techniques by analyzing various grammars including stack implementation of parser by the interpretation of results.	3
	PSO 2	Understand the basic difference between top down parsing and bottom up parsing with reference to grammars and parser generator.	2
CO 4	PO 1	Describe Intermediate forms using syntax tree and three address code using mathematical principles and scientific principles.	2
	PO 3	Explain and demonstrate the translation of simple statements, Boolean expression and flow of control statements with three address code.	2
	PO 5	Understand the concepts of three address statements and its implementation in the intermediate code generation.	1
CO 5	PO 2	Analyze the process of symbol tables in runtime environment.	1
	PO 3	Understand the concepts of runtime environment evaluate the Source languageissues.	2

CO 6	PO 1	Demonstrate the code optimization by applying the principles of mathematics and engineering fundamentals.	2
	PO 2	Understand the given problem statement and formulate the (complex) engineering problems in the Design of a Code Generator and addresses in the target Code in reaching substantiated conclusions by the interpretation of results.	3
	PO 5	Create the addresses for Design of a Code Generator (complex) Engineering activities in Computer software.	1
	PO 10	Understand code optimization techniques on intermediate code forms such as syntax trees and design documentation, for improving the performance of a program.	1
	PSO 3	Demonstrate the basic optimization in real world software, using industry standard tools and collaboration techniques in the field of application programming.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2				1								1		
CO 2	3												1		
CO 3	2	3												2	
CO 4	2		2		1										
CO 5		1	2												
CO6	2	3			1					1					1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.7	0.0	0.0	0.0	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	0.0
CO 2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	0.0
CO 3	66.7	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7	0.0
CO 4	66.7	0.0	66.7	0.0	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO 5	0.0	33.3	66.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO 6	66.7	100	0.0	0.0	33.3	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	0.0	33.3

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

2 - 40 % $< C < 60\%$ –Moderate

1-5 $< C \leq 40\%$ – Low/ Slight

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	2	-	-	-	-	-	-	-	2	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO 4	3	-	3	-	2	-	-	-	-	-	-	-	-	-	-
CO 5	-	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	3	-	-	2	-	-	-	-	2	-	-	-	-	2
TOTAL	15	8	6		6					2			4	3	2
AVERAGE	3	2	3		2					2			2	3	2

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	-	Open Ended Experiments	-
Assignments	✓				

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	INTRODUCTION TO COMPILER
	Introduction to compilers: Definition of compiler, interpreter and its differences, the phases of a compiler; Lexical Analysis: Role of lexical analyzer, input buffering, recognition of tokens, finite automata, regular Expressions, from regular expressions to finite automata, pass and phases of translation, bootstrapping, LEX-lexical analyzer generator.

MODULE II	**SYNTAX ANALYSIS**
	Syntax Analysis : Parsing, role of parser, context free grammar, derivations, parse trees, ambiguity, elimination of left recursion, left factoring, eliminating ambiguity from dangling-else grammar, classes of parsing, topdown parsing: backtracking, recursive-descent parsing, predictive parsers, LL(1) grammars Bottom-up parsing: Definition of bottom-up parsing, handles, handle pruning, stack implementation of shift- reduce parsing, conflicts during shift-reduce parsing, LR grammars, LR parsers-simple LR, canonical LR and Look Ahead LR parsers, error recovery in parsing, parsing ambiguous grammars,YACC-automatic parser generator.
MODULE III	**SYNTAX-DIRECTED TRANSLATION AND INTERMEDIATE CODE GENERATION**
	Syntax-directed translation: Syntax directed definition, construction of syntax trees, S-attributed and L- attributed definitions,syntax directed translation schemes . Intermediate code generation: Intermediate forms of source programs– abstract syntax tree, polish notation and three address code, types of three address statements and its implementation, syntax directed translation into three-address code, translation of simple statements, Boolean expressions and flow-of control statements
MODULE IV	**TYPE CHECKING AND RUN TIME ENVIRONMENT**
	Type checking: Definition of type checking, type expressions, type systems, static and dynamic checking of types, specification of a simple type checker, Run time environments: Source language issues, Storage organization, storage-allocation strategies, access to nonlocal data on the stack,garbage collection,symbol table.
MODULE V	**CODE OPTIMIZATION AND CODE GENERATION**
	Code optimization: The principle sources of optimization, optimization of basic blocks, loops in flow graphs, peephole optimization; Code generator: Issues in the design of a code generator, the target language,address in target code,Basic Blocks and flow graphs,Optimization of Basic Blocks,A simple code generator,Register allocation and assignment,DAG representation of basic blocks.

TEXTBOOKS

1. Alfred V.Aho, RaviSethi,JeffreyD, Ullman, —Compilers–Principles,TechniquesandTools, Pearson Education, 2nd Edition, 2006.

REFERENCE BOOKS:

1. Kenneth C.Louden,Thomson, —CompilerConstruction–PrinciplesandPractice, PWS Publishing, 1st Edition,1997.

2. Andrew W. Appel, —Modern Compiler Implementation C, Cambridge University Press, Revised Edition, 2004.

COURSE WEB PAGE:

1. http://csenote.weebly.com/principles-of-compiler-design.html

2. http://www.faadooengineers.com/threads/32857-Compiler-Design-Notes-full-book-pdf-download

3. http://www.e-booksdirectory.com/details.php?ebook=10166
4. http://www.e-booksdirectory.com/details.php?ebook=7400re

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO's to PO's PSO's and their attainments are discussed.		
CONTENT DELIVERY (THEORY)			
1	Introduction to compilers: Definition of compiler, interpreter and its differences	CO 1	T1:1.1-1.5 R1:1.1
2	The phases of a compiler	CO 1	T1:3.6-3.7 R1:2.2-2.4
3	Lexical Analysis: Role of lexical analyzer, input buffering	CO 1	T1: 1.5
4	recognition of tokens, finite automata.	CO 2	T1:1.1 R1:1.6
5	regular Expressions	CO 2	T1:3.8-4.3 R1:3.1-3.3
6	from regular expressions to finite automata.	CO 2	T1: 4.3-4.4 R1:4.1
7-8	pass and phases of translation, bootstrapping, LEX-lexical analyzer generator.	CO 2	T1:4.5-4.7 R1:4.3-4.5
9	Syntax Analysis: Parsing, role of parser, context free grammar.	CO 3	T1:4.5-4.7 R1:5.1-5.2
10	derivations, parse trees, ambiguity	CO 3	T1:4.7 R1:5.3
11	elimination of left recursion, left factoring	CO 3	T1: 4.7 R1:5.4-5.5
12	eliminating ambiguity from dangling-else grammar	CO 3	T1:4.7 R1:5.6
13	Types of parsing: Top-down parsing	CO 3	T1:4.9 R1:5.5
14	backtracking, recursive-descent parsing, predictive parsers,	CO 3	T1: 4.9
15	LL (1) grammars	CO 3	T1: 5.1-5.4 R1:6.1
16	Bottom-up parsing: Definition of bottom-up parsing,.	CO 3	T1:8.4-8.6
17	handles, handle pruning, stack implementation of shift-reduce parsing,	CO 3	T1: 6.1 R1:6.4-6.5
18	conflicts during shift-reduce parsing,	CO 3	T1: 7.1-7.5 R1:7.1
19	LR grammars, LR parsers-simple LR,	CO 3	T1: 7.6-7.7

20	canonical LR and Look Ahead LR parsers,	CO 3	T1: 10.2
21	YACC-automatic parser generator.	CO 3	T1:10.1-10.2 T1:10.4,9.9
22	Syntax-Directed Translation: Syntax directed definitions, construction of syntax trees	CO 4	T1: 9.1-9.2
23	S-attributed and L- attributed definitions; Syntax Directed Translation schemes.	CO 4	T1: 9.3 R1:7.6
24	Intermediate code generation: Intermediate forms of source	CO 4	T1: 9.4
25	programs– abstract syntax tree, polish notation and three address code,	CO 4	T1:9.6-9.7 R1:8.1-8.8
26	Types of three address statements and its implementation	CO 4	T1: 9.8
27	syntax directed translation into three-address code	CO 4	T1: 9.1-9.2
28	translation of simple statements, Boolean expressions	CO 4	T1: 9.1-9.2
29	Flow-of- Control statements.	CO 4	R1:8.1-8.8
30	Type checking: Definition of type checking,	CO 5	R1:8.1-8.8
31	type expressions, type systems, static and dynamic checking of	CO 5	T1: 9.4
32	specification of a simple type checker	CO 5	T1: 9.1-9.2
33	Run time environments: Source language issues,	CO 5	T1: 9.1-9.2
34	Types Storage organization	CO 5	T1: 9.1-9.2
35	storage-allocation strategies,	CO 5	T1: 9.1-9.2
36	access to nonlocal data on the stack,	CO 5	T1: 9.1-9.2
37	Garbage collection, symbol tables.	CO 5	T1: 9.1-9.2
38	Code optimization: The principle sources of optimization	CO 6	T1: 9.1-9.2
39	optimization of blocks	CO 6	T1:10.1-10.2 T1:10.4,9.9
40	loops in flow graphs	CO 6	T1: 10.2
41	peephole optimization	CO 6	T1: 9.1-9.2
42	Code Generation: Issues in the Design of a Code Generator	CO 6	T1: 9.1-9.2
43-44	The Target Language, addresses in the Target Code,	CO 6	T1:10.1-10.4
45-46	Basic Blocks and Flow Graphs	CO 6	T1: 9.1-9.2
47	Optimization of Basic Blocks	CO 6	T1: 9.1-9.2
48	A Simple Code Generator	CO 6	T1:9.6-9.7 R1:8.1-8.8
49	register allocation and assignment	CO 6	T1:9.6-9.7
50-52	DAG representation of basic blocks.	CO 6	R1:8.1-8.8

PROBLEM SOLVING/ CASE STUDIES			
1	Consider the following fragment of C code: float i, j; i = i*70+j+2; Construct the output at all phases of the compiler for above C code	CO 1	T1:1.1-1.5 R1:1.1
2	For the following expression total = count + rate * 5 Construct the output after each phase of compiler?	CO 1	T1:1.1-1.5 R1:1.1
3	Convert NFA with ϵ to equivalent NFA M=({q0,q1,q2},{0,1,2}, δ, q0, {q2}) where δ is given by [δ (q0,0)={q0}, δ (q0,1)=ϕ, δ (q0,2)=ϕ, δ(q0, ϵ)=q1] [δ (q1,0)=ϕ, δ (q1,1)=q1 , δ (q1,2)=ϕ ,δ (q1, ϵ)=q2] [δ (q2,0)=ϕ, δ (q2,1)= ϕ , δ (q2,2)= {q2},δ (q2, ϵ)= ϕ]	CO 2	T1:1.1 R1:1.6
4	Describe a DFA for the following language L={w/|w | mod5=0,w belongs to (a,b)*} L={w/|w | mod5=1,w belongs to (a,b)*}	CO 2	T1:1.1 R1:1.6
5	Describe the DFA Transition diagram for equivalent Regular expression (ab+a) *(aa+b)	CO 2	T1:3.8-4.3 R1:3.1-3.3
6	Construct the FIRST and FOLLOW sets for following grammar S$\rightarrow$ aBDh , B $\rightarrow$ cC , C $\rightarrow$ bC / ϵ , D $\rightarrow$ EF , E $\rightarrow$ g / ϵ , F $\rightarrow$ f / ϵ	CO 3	T1: 4.9
7	Construct SLR parsing table for the below grammar? E $\rightarrow$ E+T |T T $\rightarrow$ T*F | F F$\rightarrow$ (E) |id.	CO 3	T1: 7.6-7.7
8	Outline the CLR Parsing model and write the CLR parsing algorithm for constructing the parsing table	CO 3	T1: 10.2
9	Construct production rules and semantic actions for the following grammar along with annotated parse tree for the expression: "int a, b, c"? D $\rightarrow$T L T $\rightarrow$int T $\rightarrow$ float; L$\rightarrow$ L1,id L $\rightarrow$ id	CO 4	T1: 9.1-9.2
10	Construct the three address code and draw the abstract tree for the following expressions? a) (x-y)*z+m-n b) a+(b-c)+(b+c)*(a*e)	CO 4	T1: 9.1-9.2
11	Translate the expression – (a + b) * (c + d) + (a + b +c) into a) quadruples b) triples	CO 4	T1: 9.8
12	Explain briefly about Activation record with block diagram	CO 5	T1: 9.1-9.2
13	Explain the specification of a simple type checker	CO 5	R1:8.1-8.8
14	Construct the code sequence generated by the simple code generation algorithm for x*y+(m-k)-(g+b)	CO 6	T1:9.6-9.7 R1:8.1-8.8

15	Explain the concept of Function-Preserving Transformations	CO 6	T1:10.1-10.2 T1:10.4,9.9
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Definition of compiler, interpreter and its differences, the phases of a compiler	CO 1	T1:1.1-1.5 R1:1.1
2	LR grammars, LR parsers-simple LR,CLR ,LALR	CO 3	T1: 7.6-7.7
3	Syntax directed definition, construction of syntax trees, S-attributed and L- attributed definitions	CO 4	T1: 9.1-9.2
4	Storage organization, storage- allocation strategies, access to nonlocal names	CO 5	T1: 9.1-9.2
5	optimization of basic blocks, loops in flow graphs, peephole optimization; Code generator	CO 6	T1:10.1-10.2 T1:10.4,9.9
DISCUSSION ON QUESTION BANK			
1	Describe how various phases could be combined as a pass in compiler	CO 1	T1:1.1-1.5 R1:1.1
2	Identify whether the following grammar is CLR or not with reasons? S→ AA , A →aA | b	CO 3	T1: 7.6-7.7
3	Construct production rules and semantic actions for S-attributed grammar for the following grammar along with syntax tree and annotated parse tree for the given string a*b-c/d+e? L→E E→ E+T | E-T|T T→ T*F | T/F |F F→ P-F | P P→(E) P→ID	CO 4	T1: 9.1-9.2
4	Explain briefly about stack storage allocation with block diagram.	CO 5	T1: 9.1-9.2
5	Identify the register descriptor target code for the source language Statement and its cost. (a-b) + (a-c) + (a-c)	CO 6	T1:10.1-10.2 T1:10.4,9.9

Prepared by **HOD,CSE**
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COURSE DESCRIPTION

<table>
<tr><td>Department</td><td colspan="5">COMPUTER SCIENCE AND ENGINEERING</td></tr>
<tr><td>Course Title</td><td colspan="5">OBJECT ORIENTED SOFTWARE ENGINEERING</td></tr>
<tr><td>Course Code</td><td colspan="5">ACSC19</td></tr>
<tr><td>Program</td><td colspan="5">B.Tech</td></tr>
<tr><td>Semester</td><td colspan="5">V</td></tr>
<tr><td>Course Type</td><td colspan="5">Core</td></tr>
<tr><td>Regulation</td><td colspan="5">UG-20</td></tr>
<tr><td rowspan="3">Course Structure</td><td colspan="3">Theory</td><td colspan="2">Practical</td></tr>
<tr><td>Lecture</td><td>Tutorials</td><td>Credits</td><td>Laboratory</td><td>Credits</td></tr>
<tr><td>3</td><td>1</td><td>4</td><td>-</td><td>-</td></tr>
<tr><td>Course Coordinator</td><td colspan="5">Ms. D.Rajani, Assistant Professor</td></tr>
</table>

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	-

II COURSE OVERVIEW:

This course presents the concepts, methods and techniques necessary to efficiently capture software requirements in use cases and transform them into detailed designs. It combines instruction on the Unified Software Development Process (UP), object-oriented methodologies and the Unified Modeling Language. In this course, students learn how to apply the UML notation in the context of an iterative, use case-driven, architecture-centric process. They are also exposed to an advanced CASE tool that allows the rapid development of UML diagrams and promotes an agile workflow by synchronizing changes in the various models and the code.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Object Oriented Software Engineering	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could

be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
60 %	Understand
20%	Apply
10%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

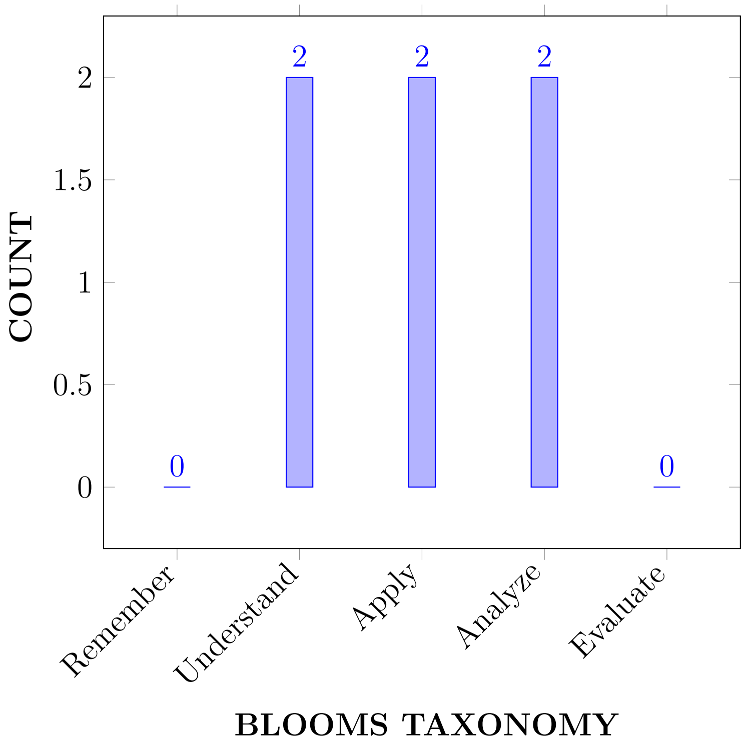
I	The object-oriented concepts along with their applicability contexts.
II	The software development process models and coding standardsL.
III	The knowledge of testing methods and comparison of various testing techniques.
IV	The underlying concepts and standards of quality and knowledge about software quality assurance group.
V	The modeling techniques to model different perspectives of object-oriented software design.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Outline** process models,apporaches and techniques for managing software development process.	Understand
CO 2	**Make use of** importance of project planning activities for selection and intiation of projects and protfolios.	Apply
CO 3	**Analyze** functional, behavioural, functional and object-oriented models for software model development.	Analyze
CO 4	**Outline** basic principles, building blocks and views for designing object-oriented architecural view of a system	Understand
CO 5	**Apply** design concepts and principles to develop components of a system.	Apply
CO 6	**Distinguish** the approaches to verification and validation of system in various stages of devlopment.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Program Outcomes	
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	SEE / CIE / AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	SEE / CIE / AAT
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction analysis and interpretation of data, and synthesis of the information to provide valid conclusions and modeling to complex engineering activities with an understanding of the limitations.	3	SEE / CIE / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	2	SEE / CIE / AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	1	SEE/AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	-	-
CO 2	-	✓	-	-	-	-	-	-	-	✓	-	✓	-	-	✓
CO 3	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	✓
CO 4	✓	-	✓	-	-	-	-	-	-	✓	-	✓	-	✓	✓
CO 5	✓	-	✓	-	✓	-	-	-	-	-	-	-	-	-	✓
CO 6	-	-	-	-	✓	-	-	-	-	✓	-	✓	-	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Usage of basic engineering tools will help to understand the problem definition and provide knowledge on IT tools.	1
	PO 5	Use of Modern tools can availthe facility to upgrade software models and designs to improve efficiency of the tools and techniques.	1
	PSO1	Apply differnt process models leads to have better solution models and upgraded designs to slove computing problems.	1
CO 2	PO 2	By identifying and analysing engineering problem can avail better project planning activities to schedule the project planning.	3
	PO 10	Software models can effectively communicate engineering problems and solutions and used to make effective reports in the project planning.	4
	PO 12	Using lifelonglearning new methodlogies will impart effective models and designs in project planning activities and schedules.	1
	PSO 3	Use of new technologies and innovation will improve the project planning and selection of protfolios.	2
CO 3	PO 1	Applying engineering knowledge will improve the performance of software models and can analyze the advantages by comparing with current and basuc models in software development.	1
	PO 3	Usage of models is to design solutions to complex software problems and helps to design system commponents acrroding to customer requirements.	7
	PSO 3	Following new trends will help to create effective software models in the context of technological change.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 4	PO 1	Using engineering basic prinicples of software design models will be able to build software architechture of the system.	1
	PO 3	Design solutions for simple and complex problems by Defining problem, understand customer requirements, identifying basic building blocks to draw UML diagrams.	6
	PO 10	Communicate with structural and behavioral design patterns effectively on complex engineering activities with the engineering community and give and receive clear instructions.	4
	PSO 3	Make use of computational and advanced CASE tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	1
CO 5	PO 1	Apply Architectural and domain model Engineering knowledge and modelling principles, in identifying basic building blocks for visualizing artifacts of system.	1
	PO 3	Design representation of Next gen POS system for simple and complex problems by Defining problem, understand customer requirements, identifying basic building blocks to draw UML diagrams.	6
	PO 5	Communicate static and dynamic aspects of the system using using system sequence and use case diagrams. For specifying structure and interaction of objects during runtime	2
	PSO 3	Formulate and Evaluate engineering concepts to Design next-generation computer systems by using advanced building blocks of UML.	1
CO 6	PO 5	Usage of modern tools of testing and software quality will improvethe standards of verification and validation of the system.	1
	PO 10	Verification and validation willcommunicate the effectiveness of the system in real - world environment before deploying the project.	4
	PO 12	In the changing technological context life- long learning will enable to adopt changes in new verification and validation methods.	1
	PSO 3	Usage of innovative verification and validation tools will improve the quality of designs amd models in creating components of system architechture.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	1	-	-	-	-	-	-	-	2	-	-
CO 2	-	3	-	-	-	-	-	-	-	4	-	1	-	-	2
CO 3	1	-	7	-	-	-	-	-	-	-	-	-	-	-	1
CO 4	1	-	6	-	-		-	-	-	4	-	-	-	-	1
CO 5	1	-	6	-	1	-	-	-	-	-	-	-	-	-	2
CO 6	-	-	-	-	1	-	-	-	-	4	-	1	-	-	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	33.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0
CO 2	0.0	33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	12.5	0.0	0.0	50.0
CO 3	33.0	0.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
CO 4	33.0	0.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	25.0
CO 5	33.0	0.0	60.0	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.	0.0	50.0	50.0
CO 6	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	80.0	0.0	12.5	0.0	50.0	25.0

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -5 $< C \leq 40\%$ – Low/ Slight
2 - 40 % $< C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	3	-	-	-	-	-	-	1	1	-	-
CO 2	-	1	-	-	-	-	-	-	-	3	-	1	-	-	2
CO 3	1	-	3	-	-	-	-	-	-	-	-	-	-	-	1
CO 4	1	-	3	-	-	-	-	-	-	3	-	-	-	-	1
CO 5	1	-	3	-	3	-	-	-	-	-	-	-	-	-	2
CO 6	-	-	-	-	3	-	-	-	-	3	-	1	-	-	1
TOTAL	4	1	12	-	9	-	-	-	-	9	-	3	1	-	7
AVERAGE	1.0	1.0	3.0	-	3.0	-	-	-	-	3.0	-	1.0	1.0	-	2.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	✓
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO SOFTWARE ENGINEERING**
	Introduction to software engineering, software development process models, agile development, project and process, project management, process and project metrics, object-oriented concepts, principles and methodologies.
MODULE II	**PLANNING AND SCHEDULING**
	Software requirements specification, software prototyping, software project planning, scope, resources, software estimation, empirical estimation models, planning, risk management, software project scheduling, object-oriented estimation and scheduling.
MODULE III	**ANALYSIS**
	Analysis modeling, data modeling, functional modeling and information flow, behavioral modeling, structured analysis, object-oriented analysis, domain analysis. Object-oriented analysis process, object relationship model, object behaviour model, design modeling with UML
MODULE IV	**DESIGN**
	Design concepts and principles, design process, design concepts, modular design, design effective modularity, introduction to software architecture, data design, transform mapping, transaction mapping, object-oriented design, system design process, object design process.
MODULE V	**IMPLEMENTATION, TESTING AND MAINTENANCE**
	Top-down, bottom-up, object-oriented product implementation and integration. Software testing methods, white box, basis path, control structure, black box, unit testing, integration testing, validation and system testing, testing tools, software maintenance and reengineering.

TEXTBOOKS

1. Ivar Jacobson, —Object Oriented Software Engineering: A Use Case Driven Approach, Pearson India, 1st Edition, 2002.
2. Bernd Bruegge, Allen H. Dutoit, —Object-Oriented Software Engineering: Using UML, Patterns and Java, Pearson New International Edition, 3rd Edition, 2013.

REFERENCE BOOKS:

1. Roger. S. Pressman and Bruce R. Maxim, —Software Engineering – A Practitioner's Approach, McGraw Hill, 7th Edition, 2015.
2. Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Pearson Education, 3rd Edition, 2008.

WEB REFERENCES:

1. https://www.cse.iitb.ac.in/ sunita/cs725/calendar.html
2. https://ece.iisc.ac.in/ parimal/2019/ml.html
3. https://www.springer.com/gp/book/9780387848570

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	https://lms .iare.ac.in/ index ?route =course/details & course id=137
CONTENT DELIVERY (THEORY)			
1	Introduction to software engineering.	CO 1	T1:1.1
2	software development process models.	CO 1	T1:1.2
3	agile development	CO 1	T1:1.3-1.4
4	agile models	CO 1	T1:1.3-1.4
5	project and process	CO 1	T1:2.3
6	project management	CO 1	T1:2.3
7	process and project metrics	CO 1	T1:2.4
8	object-oriented concepts, principles and methodologies.	CO 1	T1:2.5
9	Software requirements specification	CO 2	T1:4.1
10	software prototyping	CO 2	T1:5.1
11	software prototyping models	CO 2	T1:5.1
12	software project planningscope, resources.	CO 2	T1:6.1
13	software estimation	CO 2	T1:7.1.1
14	empirical estimation models	CO 2	T1:7.1.1
15	planning, risk management	CO 2	T1:8.1.1
16	software project scheduling	CO 2	T1:11.4
17	object-oriented estimation and scheduling.	CO 2	T1:11.4
18	Analysis modeling	CO 3	T1:12.5
19	data modeling, functional modeling.	CO 3	T1:12.5
20	information flow	CO 3	T1:13.1
21	behavioral modeling.	CO 3	T1:13.1
22	structured analysis	CO 3	T1:14.1

23	object-oriented analysis	CO 3	T1:14.1
24	domain analysis.	CO 3	T1:14.1
25	Object-oriented analysis process	CO 4	T2: 5.2
26	Object relationship model	CO 4	T2: 5.2
27	object behaviour model.	CO 4	T2: 5.2
28	design modeling with UML	CO 4	T1:16.1
29	Design concepts and principles	CO 5	T1:16.4
30	Design process	CO 5	T1:16.4
31	design concepts.	CO 5	T1:16.4
32	modular design	CO 5	T1:20.5
33	design effective modularity.	CO 5	T1:20.5
34	introduction to software architecture.	CO 5	T1:21.4
35	data design.	CO 5	T1:21.4
36	transform mapping.	CO 5	T1:22.1
37	transaction mapping.	CO 5	T1:22.1
38	object-oriented design,	CO 6	T1:22.4
39	system design process	CO 6	T1:22.4
40	object design process	CO 6	T1:22.4
41	Top-down	CO 6	T1:22.7
42	bottom Up	CO 6	T1:22.7
43	object-oriented product implementation	CO 6	T1:22.7
44	integration	CO 6	T1:29.1
45	Software testing methods	CO 6	T1:29.3
46	white box testing	CO 6	T1:29.3
47	basis path testing	CO 6	T1:29.3
48	control structure	CO 6	T1:29.3
49	black box testing	CO 6	T1:29.3
50	unit testing	CO 6	T1:30.1
51	integration testing	CO 6	T1:30.1
52	validation and system testing	CO 6	T1:30.1
53	testing tools	CO 4	T1:30.7
54	software maintenance and reengineering.	CO 4	T1:30.7
55	Case Study: The Unified Library Application.	CO 4	T1:30.9
56	Case Study: Real-Time applications.	CO 6	T1:30.9
PROBLEM SOLVING/ CASE STUDIES			
1	Build a class hierarchy to organize the following drink classes: Mineral water, alcoholic, nonalcoholic, grape juice and soda.	CO 1	T2:2.1
2	Classify and describe four fundamental process activities which are common to all software processes.	CO 2	T2:2.3

3	List four facts which indicate that the requirement capture and analysis process to be very difficult.	CO 2	T2:2.3.1
4	Construct an object diagram that contains a three-level hierarchy of objects.	CO 6	T2:7.2,7.3
5	Assume that you wise to buy a car. Identify all the attributes and methods of the car object. Write a short description of services that each will provide. Create a class hierarchy of the "car" class.	CO 6	T2:10.3.1
6	Build basic class diagrams (of your choice) to identify and describe key concepts like classes, types in the system and their relationships.	CO 4	T2:13.3
7	Draw and model the activity diagrams to display either business flows or like flow charts. (Example: ATM system)	CO 4	T2:17.1.1, 17.1.3
8	Construct an activity diagram the shows flow of control from activity to another by modeling a credit card validation system with swim lanes.	CO 4	T2:18.1, 18.2.1
9	Develop the activity diagram for the process sale and specify actor, use case and scenario with swim lanes.	CO 4	T2:18.3.4, 18.3.4.1
10	Model a state machine for the controller of a home security system, which is responsible for monitoring various sensors around the perimeter of the house.	CO 6	T2:22.12, 19.1.2
11	Develop a state chart diagram of an ATM system.	CO 4	T2:18.4, 18.4.3
12	Develop a state chart diagram for the case study on the Next Gen POS system with suitable examples.	CO 6	T2:19.2, 18.4.4
13	Construct UML deployment and component diagrams for ATM system.	CO 1	T2:23.1.1, 23.1.3
14	Consider the Hospital Management System application with the following requirements i. System should handle the in- patient, out-patient information through receptionist. ii. Doctors are allowed to view the patient history and give their prescription iii. There should be a information system to provide the required information Construct the component and deployment diagram	CO 5	T2:18.3.4, 18.3, 4.1
15	Explain in detail about the notations of a sequence diagram with neat sketch.	CO 4	T2:24.2,28.4
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Software engineering models, project and process management	CO 1	T2:18.3.4, 18.3.4.1

2	Software Requirement specification,project planning and scheduling	CO 2	T2:22.12, 19.1.2
3	software modelling, design and analysis	CO3, CO 4	T2:18.4, 18.4.3
4	Design concepts and principles	CO 5	T2:19.2, 18.4.4
5	Software testing and validation	CO 6	T2:23.1.1, 23.1.3
DISCUSSION ON QUESTION BANK			
1	Introduction to software engineering	CO 1	T2:18.3.4, 18.3.4.1
2	Project planning and scheduling	CO 2	T2:22.12, 19.1.2
3	architectural modeling, Advanced Behavioral Modeling	CO3,CO4	T2:18.4, 18.4.3
4	Design concepts and principles	CO 5	T2:19.2, 18.4.4
5	Software testing and validation	CO 6	T2:23.1.1, 23.1.3

Signature of Course Coordinator **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	COMPUTER SCIENCE AND ENGINEERING				
Course Title	WEB APPLICATION DEVELOPMENT				
Course Code	AITC09				
Program	B.Tech				
Semester	V				
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	1.5
Course Coordinator	Dr.D.Durga Bhavani, Associate Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC05	II	Programming For Problem Solving Using C
B.Tech	AITC02	III	Programming with Objects

II COURSE OVERVIEW:

This course introduces students to create concurrently a web app and a native app (for Android and iOS) with React Native and React Native Web. It covers HTML for structuring and presenting content on the World Wide Web. CSS being used to format structured content. To create a dynamic and interactive experience for the user it covers JAVASCRIPT. How build the applications using React concepts such as JSX, REDUX.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
WEB APPLICATION DEVELOPMENT	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
33.3%	Remember
55.5 %	Understand
11.1 %	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

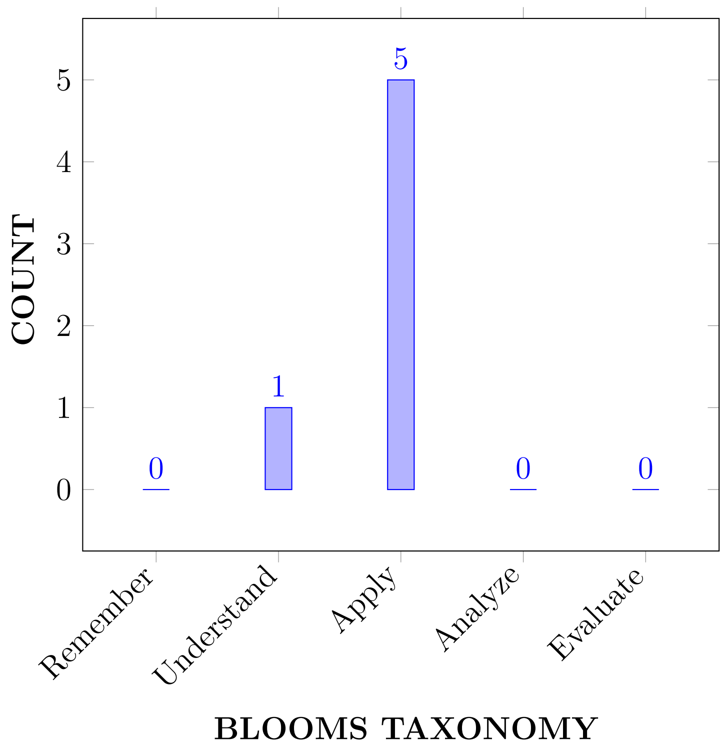
I	The characteristics, systematic methods, model for developing web applications.
II	The fundamentals of HTML and CSS to design static and dynamic web pages.
III	The concepts of client side programming with Bootstrap ,JavaScript, Ajax , JSX.
IV	The MVC architecture, about React and built single and multiple page applications using REACT with REDUX.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Summarize** HTML elements and attributes for structuring and presenting content of webpage based on the user requirement .	Understand
CO 2	**Make use of** CSS properties for formatting webpages.	Apply
CO 3	**Develop** responsive webpage using Bootstrap for viewing web pages in various devices	Apply
CO 4	**Utilize** the concepts of JS with event actions for displaying information on webpages.	Apply
CO 5	**Identify** UI binding library elements for deploying a reusable complex UI.	Apply
CO 6	**Develop** a native web application with the help of React framework.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES :

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	Assignments/ Discussion
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	CIE/Quiz/AAT
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	CIE/Quiz/AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	CIE/Quiz/AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	1	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design and analyse computer programs in the areas related to Algorithms, Systems, Software, Web design, Big Data, Artificial Intelligence, Machine Learning and Networking.	1	CIE/Quiz/AAT
PSO 3	Make use of modern computer tools for building career paths, to be an entrepreneur and desire for higher studies..	2	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 2	✓	-	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 3	✓	-	-	✓	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 4	✓	-	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 5	✓	-	-	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 6	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	**Knowledge** of web and components strongly helps student to **design and develop** web based **engineering solutions**	3
	PO 3	**Designing and developing** static and dynamic web pages can help the student to design and develop **practical solutions**, to common problems, over the web.	2
	PO 5	Apply appropriate techniques, **modern Engineering and IT tools** to design a web page with HTML and CSS and use search tools such as browsers to produce the view of webpage .	1
	PO 10	**Communicate** effectively on complex Engineering activities with the Engineering community related to web development and with society at large, to design web pages and write effective Programming by using the elements of HTML and CSS.	1
	PO 12	Recognize the need for advanced concepts related to HTML and CSS for understanding and developingweb applications through continuing education efforts with ongoing learning – stays up with industry trends.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 1	Identify the Customer needs and problem specific constraints in designing web pages related to the basic concepts of HTML and CSS.	2
	PSO 3	Make use of modern computer tool in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms and desire for higher studies.	3
CO 2	PO 1	**Knowledge** of web and components strongly helps student to **design and develop** web based **engineering solutions**	3
	PO 3	**Designing and developing** static and dynamic web pages can help the student to **design and develop** practical solutions, to common problems, over the web.	2
	PO 5	Apply appropriate techniques, **modern Engineering and IT tools** to design a web page with HTML and CSS and use search tools such as browsers to produce the view of webpage .	1
	PO 10	**Communicate** effectively on complex Engineering activities with the Engineering community related to web development and with society at large, to design web pages and write effective Programming by using the elements of HTML and CSS.	1
	PO 12	Recognize the need for advanced concepts related to HTML and CSS for understanding and developingweb applications through continuing education efforts with ongoing learning – stays up with industry trends.	1
	PSO 1	Identify the Customer needs and problem specific constraints in designing web pages related to the basic concepts of HTML and CSS.	2
	PSO 3	Make use of modern computer tool in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms and desire for higher studies.	3
CO 3	PO 1	**Knowledge** of web and components strongly helps student to **design and develop** web based **engineering solutions**.	3
	PO4	**Design of experiments** with the **knowledge** in web architecture	2
	PO 5	**Developing** real world web application using Javascript familiarize the student to modern tools for web development	1
	PO 10	**Communicate** effectively on complex Engineering activities with the Engineering community related to web development and with society at large, to design web pages and write effective Programming by using Bootstrap	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 12	Recognize the need for advanced concepts in developing web applicationsand through continuing education efforts with ongoing learning – stays up with industry trends/ new technology related to the concepts of HTML,Javascript,Ajax..	1
	PSO 1	Identify the Customer needs and problem specific constraints in designing web pages related to the basic concepts of Bootstrap.	2
	PSO 3	Make use of modern computer tool in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms and desire for higher studies.	3
CO 4	PO 1	**Knowledge** of web and components strongly helps student to **design and develop** web based **engineering solutions**	3
	PO 3	**Designing and developing** static and dynamic web pages can help the student to design and develop **practical solutions**, to common problems, over the web.	2
	PO 5	**Developing** real world web application using Javascript familiarize the student to modern tools for web development	1
	PO 10	**Communicate** effectively on complex Engineering activities with the Engineering community related to web development and with society at large, to design web pages and write effective Programming by using **Java Script , Ajax and React**	1
	PO 12	Recognize the need for advanced concepts in developing web applicationsand through continuing education efforts with ongoing learning – stays up with industry trends/ new technology related to the concepts of HTML,Javascript, Ajax	1
	PSO 1	Identify the Customer needs and problem specific constraints in designing web pages related to the basic concepts of **Java Script , Ajax and React**	2
	PSO 3	Make use of **modern computer tool** in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms and desire for higher studies.	4
CO 5	PO 1	**Knowledge** of web and components strongly helps student to **design and develop** web based **engineering solutions**	3
	PO 5	**Developing** real world web application using React and Redux familiarize the student to modern tools for web development	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	**Communicate** effectively on complex Engineering activities with the Engineering community related to web development and with society at large, to design web pages and write effective Programming by using **React and Redux**	1
	PO 12	Recognize the need for advanced concepts in developing web applications through continuing education efforts with ongoing learning – stays up with industry trends/ new technology related to the concepts of React..	1
	PSO 1	Identify the Customer needs and problem specific constraints in designing web pages related to the basic concepts of **React and Redux**	2
	PSO 3	Make use of **modern computer tool** in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms and desire for higher studies.	4
CO 6	PO 1	**Knowledge** of web and components strongly helps student to **design and develop** web based **engineering solutions**	3
	PO 2	With the **analysis** of Javascript applications Analyze **complex engineering** problems.	2
	PO 3	**Designing and developing** static and dynamic web pages can help the student to design and develop **practical solutions**, to common problems, over the web.	2
	PO 5	**Developing** real world web application using React and Redux familiarize the student to modern tools for web development	1
	PO 10	**Communicate** effectively on complex Engineering activities with the Engineering community related to web development and with society at large, to design web pages and write effective Programming by using **React App and Redux API**	1
	PO 12	Build web applications according to technological changes done in software environment trelated to the concepts of AJAX, React native, Redux with databinding connectivity through continuing education efforts with ongoing learning...	1
	PSO 1	Identify the Customer needs and problem specific constraints in designing web pages related to the basic concepts of **React App and Redux API**	2
	PSO 3	Make use of **modern computer tool** in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms and desire for higher studies.	4

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	9	4	6
CO 1	3	-	2	-	1	-	-	-	-	1	-	1	2	-	3
CO 2	3	-	2	-	1	-	-	-	-	1	-	1	2	-	3
CO 3	3	-	-	2	1	-	-	-	-	1	-	1	2	-	3
CO 4	3	-	2	-	1	-	-	-	-	1	-	1	2	-	4
CO 5	3	-	-	-	1	-	-	-	-	1	-	1	2	-	4
CO 6	3	2	2	-	1	-	-	-	-	1	-	1	2	-	4

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	9	4	6
CO 1	100	-	20	-	100	-	-	-	-	20	-	12.5	22.2	-	50
CO 2	100	-	20	-	100	-	-	-	-	20	-	12.5	22.2	-	50
CO 3	100	-	-	18	100	-	-	-	-	20	-	12.5	22.2	-	50
CO 4	100	-	20	-	100	-	-	-	-	20	-	12.5	22.2	-	66.6
CO 5	100	-	-	-	100	-	-	-	-	20	-	12.5	22.2	-	66.6
CO 6	100	20	20	-	100	-	-	-	-	20	-	12.5	22.2	-	66.6

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -$5 < C \leq 40\%$ – Low/ Slight

2 - $40\% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	9	4	6
CO 1	3	-	1	-	3	-	-	-	-	1	-	1	1	-	2
CO 2	3	-	1	-	3	-	-	-	-	1	-	1	1	-	2
CO 3	3	-	-	1	3	-	-	-	-	1	-	1	1	-	2
CO 4	3	-	1	-	3	-	-	-	-	1	-	1	1	-	3
CO 5	3	-	-	-	3	-	-	-	-	1	-	1	1	-	3
CO 6	3	1	1	-	3	-	-	-	-	1	-	1	1	-	3
TOTAL	18	1	4	-	18	-	-	-	-	6	-	6	6		15
AVERAGE	3	1	1	1	3	-	-	-	-	1	-	1	1	-	2

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	PO 4	Open Ended Experiments	-
Assignments	-	-	-	-	

XVII ASSESSMENT METHODOLOGY-INDIRECT:

-	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO WEB APPLICATION AND HYPERTEXT MODELLING**
	Introduction to web application, Basics of hypertext modeling, hypertext structure modeling concepts, access modeling concepts, relation to content modeling, presentation modeling, relation to hypertext modeling, customization modeling, relation to content, hypertext, and presentation modeling. Basics of HTML5 and web design, creating tables, HTML forms, styles and classes to your web pages, web page layouts with CSS, introduction to responsive web design with CSS3 and HTML5.
MODULE II	**BUILD INTERFCAES USING BOOTSTARP**
	Introduction to web design from an evolutionary perspective, user interface design through bootstrap, containers, tables, jumptrons, list, cards, carousal, navigation, modals, flex and forms, responsive web page design, basic UI grid structure.
MODULE III	**INTERACTIVE USER INFERFACE AND WEB APPLICATION DEVELOPMENT**
	JavaScript variable naming rules, data types, expressions and operators, pattern matching with regular expressions, managing web page styles using JavaScript and CSS, script forms, introduction to AJAX. Introduction to web design from an evolutionary perspective, create a native and web app, JSX, class and function components, props, state, lifecycle methods, and hooks
MODULE IV	**UI BINDING LIBRARY FOR REACT**
	Introduction to client-side routing using React Router, global state management and transitions using REDUX, server side rendering and testing using Jest, Enzyme and more. Web Development Using REACT is delivered both in a blended learning and self-paced mode.
MODULE V	**CONNECT TO AN EXTERNAL API**
	REDUX store using the official create store function, REDUX toolkit has a configure store API, loading state for that particular API, adding an API service as a middleware, example uses create REACT App.

TEXTBOOKS

1. Alok Ranjan Abhilasha Sinha, Ranjit Battewad, "JavaScript for Modern Web Development: Building a Web Application Using HTML, CSS, and JavaScript", 1st Edition,2020.
2. Alex Banks and Eve Porcello, "Learning React: Functional Web Development with React and Redux", 2017

REFERENCE BOOKS:

1. Adam Boduch and Roy Derks, "React and React Native: A complete hands-on guide to modern web and mobile development with React.js", 3rd Edition, 2020.
2. W Hans Bergsten, "Java Server Pages", O'Reilly, 3rd Edition, 2003.
3. D.Flanagan, "Java Script", O'Reilly, 6th Edition, 2011.
4. Jon Duckett, "Beginning Web Programming", WROX, 2nd Edition, 2008.

WEB REFERENCES:

1. https://nptel.ac.in/courses/112105171/1

COURSE WEB PAGE:

1. lms.iare.ac.in

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Institutions adopting OBE try to bring changes to the curriculum by dynamically adapting to the requirements of the different stakeholders like Students, Parents, Industry Personnel and Recruiters. OBE is all about feedback and outcomes. In this we will discuss about the course outcomes and program outcomes and their attainment		
CONTENT DELIVERY (THEORY)			
1	Introduction to web application	CO1	T2: 1.1-1.3
2	Basics of hypertext modeling	CO1	T2: 1.1-1.4
3	hypertext structure modeling concepts	CO1	T2: 1.1-1.3
4	access modeling concepts	CO1	T2: 1.1-1.5
5	relation to content modeling	CO1	T2: 1.1-1.6
6	presentation modeling	CO1	T2: 1.1-1.7
7	relation to hypertext modeling	CO1	T2: 1.1-1.7
8	customization modeling	CO1	T2: 1.1-1.7
9	relation to content, hypertext, and presentation modeling	CO1	T2: 1.1-1.8
10	relation to content, hypertext, and presentation modeling	CO1	T2: 1.1-1.8
11	Basics of HTML5 and web design	CO1	T2: 1.1-1.9
12	creating tables	CO1	T2: 1.1-1.9
13	HTML LIST	CO1	T2: 1.1-1.9
14	HTML Forms	CO1	T2: 1.1-1.9
15	styles and classes to your web pages	CO2	T2: 1.1-1.9
16	web page layouts with CSS	CO2	T2: 1.1-1.9
17	Types of CSS	CO2	T2: 1.1-1.9

18	Types of Selectors	CO2	T2: 1.1-1.9
19	Introuction to DIV tag	CO2	T2: 1.1-1.9
20	Introduction to responsive web design with CSS3 and HTML5	CO2	R2: 3.4-3.9
21	Introduction to web design from an evolutionary perspective	CO3	R2: 4.1-4.3
22	bootstrap containers	CO3	R2: 4.1-4.3
23	bootstrap tables	CO3	R2: 4.1-4.3
24	bootstrap jumptrons	CO3	R2: 4.1-4.3
25	bootstrap list	CO3	R2: 4.1-4.3
26	bootstrap cards	CO3	R2: 4.1-4.3
27	bootstrap carousal	CO3	R2: 4.1-4.3
28	bootstrap navigation	CO3	R2: 4.1-4.3
29	bootstrap modals	CO3	R2: 4.1-4.3
30	bootstrap flex and forms	CO3	T1: 27.1, T1:27.2, 27.6
32	bootstrap flex and forms	CO3	T1: 27.1, T1:27.2, 27.6
33	responsive web page design	CO3	T1: 27.1, T1:27.2, 27.6
34	basic UI grid structure	CO3	T1: 27.1, T1:27.2, 27.6
35	basic UI grid structure	CO3	T1: 27.1, T1:27.2, 27.6
36	JavaScript variable naming rules	CO4	T2: 4.1-4.3
37	data types, expressions	CO4	T2: 4.1-4.4
38	Java Script operators	CO4	T2: 4.1-4.5
39	Java Script pattern matching	CO4	TT2: 4.1-4.6

40	Types of regular expressions	CO4	T2: 4.1-4.7
41	pattern matching with regular expressions	CO4	T2: 4.1-4.8
42	pattern matching with regular expressions	CO4	T2: 4.1-4.8
43	managing web page styles using JavaScript and CSS,	CO4	T2: 4.9-4.10
44	validate the script forms	CO4	T2: 4.9-4.11
45	introduction to AJAX.	CO4	T2: 5.1
46	Introduction to web design from an evolutionary perspective	CO5	T1: 4.4-4.7
47	Icreate a native and web app	CO5	1: 4.4-4.7
46	Introduction to JSX	CO5	T1: 4.4-4.7
48	React class and function components	CO5	R1: 1.1-1.4
49	React props, state	CO5	T1: 4.4-4.7
50	React lifecycle methods and HOOKS	CO5	T1: 4.4-4.7
51	Introduction to client-side routing using React Router	CO5	T1 8.1-8.4
52	global state management and transitions using REDUX	CO5, CO6	T1:9.1, 9.3,9.4,9.6
53	server side rendering	CO5	T1:11.1,11.3-11.4
54	testing using Jest, Enzyme and more	CO5	T1:11.1,11.3-11.4
55	Web Development Using REACT is delivered both in a blended learning and self-paced mode.	CO5	T1:11.1,11.3-11.4
56	REDUX store using the official create store function	CO6	T1: 26.2, 26.6.4, T2:26.6.6, 26.10
57	REDUX toolkit has a configure store API,	CO6	T1: 26.2, 26.6.4, T2:26.6.6, 26.10
58	REDUX toolkit has a configure store API	CO6	T1:11.1,11.3-11.4
59	loading state for that particular API	CO6	T1:26.1-26.3
60	loading state for that particular API	CO6	T1:26.1-26.3
61	adding an API service as a middleware	CO6	T1:27.1-27.6

62	adding an API service as a middleware	CO6	T1:11.1,11.3-11.4
63	example uses create REACT App.	CO6	T1:25.1-25.6
CASE STUDIES			
1	Design the static web pages required for an online book store web site	CO 2	T1:11.2.1
2	Design A basic Bootstrap table has a light padding and only horizontal dividers.	CO3	T1:11.2.2
3	Creating buttons with Bootstrap 2Creating outline buttons styles in Bootstrap 3.Creating large buttons with Bootstrap 4.Creating small buttons with Bootstrap 5.Creating block buttons with Bootstrap 6.Creating disabled Bootstrap buttons using the input and button element	CO3	T1:11.2.18
4	Create a "registration form "with validattion the following fields 1) Name (Text field) 2) Password (password field) 3) E-mail id (text field) 4) Phone number (text field) 5) Sex (radio button) 6) Date of birth (3 select boxes) 7) Languages known (check boxes – English, Telugu, Hindi, Tamil) 8) Address (text area) finally submit button and clear button .	CO4	T1:11.2.25
5	Create Tables using Bootstrap such as striped table with bordered and Hover rows.	CO 3	T1:11.4.1
6	Evolve Home, About us pages and layout using Reactjs.	CO 5	T1:11.4.2
7	What are the different ways to style a React component?define them with example?	CO 5	R2:7.5
8	Write down the program to create a switching component for displaying different pages?	CO 6	R2:7.5
9	Write down the program to create forms in React?	CO 6	R2:7.5
10	Develop the calculator using javascript, html and css.	CO co4	R2:7.5
11	a. To create a CountApp using React HOOKS	CO 5	T1:11.4.1
12	Develop a web application to control over different layouts.	CO 2	T1:11.4.2
13	Develop a basic web pages using Reactjs.	CO 5	T1:11.5.1
14	Using hooks create state object and update the state of component in reactjs	CO 5	T1:11.5.2
15	Develop Drop-Down Navigation Bar using Bootstrap framework	CO 3	T2:7.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Module I: Introduction To Web Application And Hypertext Modelling	CO 1	R1:2.1-2.11
2	Module II:Build Interfcaes Using Bootstarp	CO 2, 3	R1:4.2-4.11
3	Module III: Interactive User Inferface And Web Application Development	CO 4	R2:5.6-5.9
4	Module IV:UI Binding Library for React	CO 5	R4:8.1-8.9

5	Module V: Connect to an external API	CO 6	R2:12.1-12.16
DISCUSSION OF QUESTION BANK			
1	Module I: Introduction To Web Application And Hypertext Modelling	CO 1,	R1:2.1-2.11
2	Module II:Build Interfcaes Using Bootstarp	CO 2, 3	R1:4.2-4.11
3	Module III: Interactive User Inferface And Web Application Development	CO 4	R2:5.6-5.9
4	Module IV: UI Binding Library for React	CO 5	R4:8.1-8.9
5	Module V:Connect to an external API	CO 6	R2:12.1-12.16

Signature of Course Coordinator **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**Computer Science and Engineering**
Course Title	**Embedded Systems**
Course Code	AECC40
Program	B. Tech
Semester	V
Course Type	Open Elective-II
Regulation	UG-20

Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-

Course Coordinator	Mr. B. Brahmaiah, Assistant Professor

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
B.Tech	ACSC07	III	Computer Organization and Architecture	3
B.Tech	ACSC12	IV	Operating Systems	3

II COURSE OVERVIEW:

This course allows students to learn the fundamentals of embedded system hardware and firmware design. It focusses on embedded system design process, embedded C, interfacing modules, software development tools for debugging and testing of embedded applications, ARM and SHARC processor architectures and memory organization. It provides hands-on experience on implementation of embedded application prototype design using embedded C.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Embedded Systems	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
66.6%	Understand
16.6 %	Apply
16.6 %	Analyze
0%	Evaluate
0%	Create

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	AAT	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Videos	Tech-talk	Open Ended Experiment
50%	50%	-

VI COURSE OBJECTIVES:

The students will try to learn:

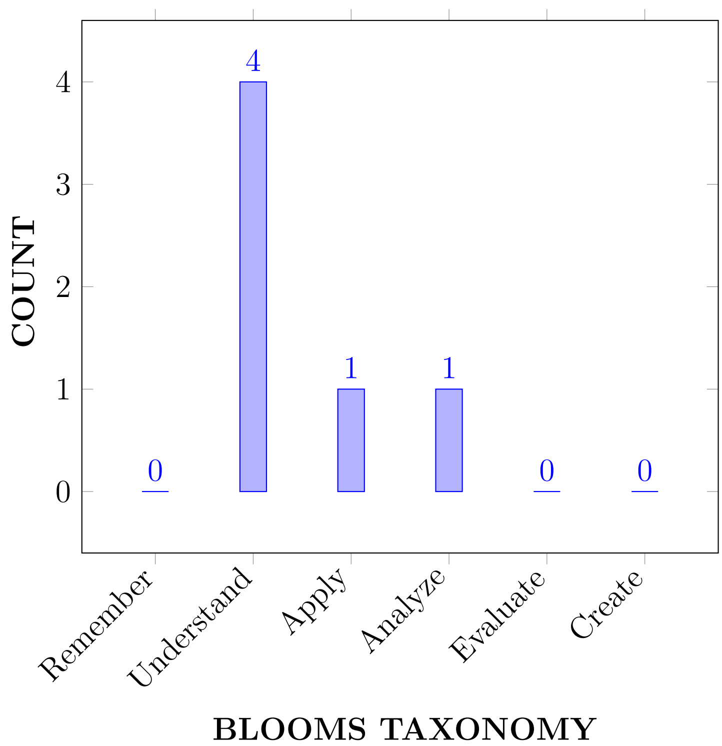
I	The concepts of embedded computing, embedded C, RTOS and embedded software tools for implementing embedded systems.
II	Embedded software development tools for debugging and testing of embedded applications, architectures of ARM and SHARC processors.
III	Interfacing with external environments using sensors, actuators and communication in distributed embedded systems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Summarize** the concepts of Embedded Systems and formalisms for system design with examples.	Understand
CO 2	**Examine** and write the Embedded Systems programming in C with Keil Integrated Development Environment (IDE).	Analyze
CO 3	**Demonstrate** the principles of RTOS and the methods used for saving memory and power in real time environments.	Understand
CO 4	**Make use of** embedded software development tools for debugging and testing of embedded applications.	Apply
CO 5	**Illustrate** the architecture, memory organization and instruction level parallelism of ARM and SHARC processors used in Embedded Systems.	Understand
CO 6	**Interpret** the concepts of Internet of Things used in the embedded systems applications.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE/CIE/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	SEE/CIE/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	SEE/CIE/AAT
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	SEE/CIE/AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	SEE/CIE/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data,**Artificial Intelligence, Machine Learning** and Networking.	2	AAT / Projects

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 2	✓	✓	✓	-	✓	-	-	-	-	✓	-	-	-	-	-
CO 3	✓	-	-	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 4	✓	✓	✓	-	✓	-	-	-	-	✓	-	-	-	-	-
CO 5	✓	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 6	✓	✓	✓	-	-	-	-	-	-	✓	-	-	-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO1	PO 1	Illustrate the concepts (knowledge) of embedded systems using their architectures by using **mathematics, science, engineering fundamentals** to the solution of complex engineering problems.	3
	PO 10	Describe the concepts of Embedded Systems and formalisms by **giving effective presentations and take clear instructions** for system design with examples.	1
	PSO1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	1
CO2	PO 1	Apply the integration of sensors, actuators and on-chip peripherals of microcontroller architectures for prototype design by applying **science** and **engineering fundamentals**.	2
	PO 2	Understand the given embedded application **problem statement** and finding the solution implementation and select proper language for **information and data collection** for **solution development** by writing embedded C language programming efficient and **interpretation of results**.The prototype embedded system design by analyzing complex engineering problems.	4
	PO 3	**Manage the design process** and make **use of creativity to establish solutions** by selecting proper syntaxes to write the embedded C language programming by **understanding of the requirement for engineering activities to promote sustainable development** and design solutions for complex Engineering problems and design system components of embedded applications that meet the specified needs with appropriate consideration for the public **health and safety, and the cultural, societal, and Environmental considerations.**	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO2	PO 5	Select and apply appropriate techniques of **(Modern Tool Usage)** Keil Integrated Development Environment, for design of the basic embedded modules using different electronic circuits to provide valid conclusions.	1
	PO 10	Use Keil Integrated Development Environment by **giving effective presentations and take clear instructions** for analyzing the Embedded Systems programming in C.	1
CO3	PO 1	Demonstrate (knowledge) the principles of RTOS such as interrupt latency and context switching in hard real time environments by applying the knowledge of **mathematical model, science and engineering fundamentals**	3
	PO 10	Describe the principles of RTOS and the methods used for saving memory and power with Keil Integrated Development Environment by **giving effective presentations and take clear instructions** in real time environments.	1
	PSO1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	1
CO4	PO 1	Make use of embedded software development tools (knowledge) for debugging and testing of embedded applications to the solution of complex engineering problems using **mathematics, science, engineering fundamentals**.	3
	PO 2	**Identify the problem** and understand the given embedded application and choose necessary hardware and software interface for **information and data collection** and **conduct experimental design** and **finding the solution implementation** of embedded applications using development tools by analyzing complex engineering problems.	4
	PO 3	**Understand the customer and user needs** and select an appropriate RTOS and Software development tools by **managing the design process and evaluate outcomes** to **promote sustainable development** for data transfer between the devices using **creativity to establish innovative solutions**.	4
	PO 5	Create, select, and apply appropriate techniques, resources, and modern Engineering tools including prediction and modelling the embedded circuits using **Keil integrated development environment tool** to complex Engineering activities with an understanding of the limitations.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO4	PO 10	Use embedded software development tools by **giving effective presentations and take clear instructions** for debugging and testing of embedded applications.	1
CO5	PO 1	Understand (knowledge) the architecture, memory management and application development using ARM and SHARC processors by applying **science and engineering fundamentals**.	2
	PO 10	Explain the architecture, memory organization and instruction level parallelism of ARM and SHARC processors by **giving effective presentations and taking clear instructions**.	1
CO6	PO 1	Model a embedded application prototype using embedded C by applying **engineering fundamentals**.	1
	PO 2	Understand the **problem statement** and **solve** embedded **prototype implementation** using the concepts of Internet Of Things **(information and data collection)** and **interpret the results** in global engineering applications in complex problem analysis using mathematics.	5
	PO 3	**Using creativity to establish innovative solutions** and **understanding of the requirement for engineering activities to promote sustainable development** for design a complex engineering problems and real time processes that meet the specified needs with appropriate consideration for the **public health and environmental considerations**.	3
	PO 10	Interpret the concepts of Internet of Things used in embedded systems applications by **giving effective presentations and taking clear instructions**.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	8	2	2	2
CO 1	3	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO 2	2	4	4	-	1	-	-	-	-	1	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO 4	3	4	4	-	1	-	-	-	-	1	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO 6	1	5	3	-	-	-	-	-	-	1	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	20	-	-	50	-	-
CO 2	66.6	40	40	-	100	-	-	-	-	20	-	-	-	-	-
CO 3	100	-	-	-	-	-	-	-	-	20	-	-	50	-	-
CO 4	100	40	40	-	100	-	-	-	-	20	-	-	-	-	-
CO 5	66.6	-	-	-	-	-	-	-	-	20	-	-	-	-	-
CO 6	33.3	50	30	-	-	-	-	-	-	20	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	1	-	-	2	-	-
CO 2	3	1	1	-	3	-	-	-	-	1	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-	-	1	-	-	2	-	-
CO 4	3	1	1	-	3	-	-	-	-	1	-	-	-	-	-
CO 5	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO 6	1	2	1	-	-	-	-	-	-	1	-	-	-	-	-
TOTAL	16	4	3	-	6	-	-	-	-	4	-	-	6	-	-
AVERAGE	2.66	1.33	1	-	3	-	-	-	-	1	-	-	2	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	AAT	✓
Quiz	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	-	Open Ended Experiments	-
Seminars	-	Laboratory Practices	-		

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✓	Assessment of activities / Modeling and Experimental Tools in Engineering by Experts		

XVIII SYLLABUS:

MODULE I	**EMBEDDED COMPUTING**
	Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, complex systems and microprocessor, classification, major application areas, the embedded system design process, characteristics and quality attributes of embedded systems, formalisms for system design, design examples.
MODULE II	**INTRODUCTION TO EMBEDDED C AND APPLICATIONS**
	C looping structures, register allocation, function calls, pointer aliasing, structure arrangement, bit fields, unaligned data and endianness, inline functions and inline assembly, portability issues; Embedded systems programming in C, binding and running embedded C program in Keil IDE, dissecting the program, building the hardware; Basic techniques for reading and writing from I/O port pins, switch bounce; Applications: Switch bounce, LED interfacing, interfacing with keyboards, displays, D/A and A/D conversions, multiple interrupts, serial data communication using embedded C interfacing.
MODULE III	**RTOS FUNDAMENTALS AND PROGRAMMING**
	Operating system basics, types of operating systems, tasks and task states, process and threads, multiprocessing and multitasking, how to choose an RTOS ,task scheduling, semaphores and queues, hard real-time scheduling considerations, saving memory and power. Task communication: Shared memory, message passing, remote procedure call and sockets; Task synchronization: Task communication synchronization issues, task synchronization techniques, device drivers.
MODULE IV	**EMBEDDED SOFTWARE DEVELOPMENT TOOLS**
	Host and target machines, linker/locators for embedded software, getting embedded software into the target system; Debugging techniques: Testing on host machine, using laboratory tools, an example system.
MODULE V	**INTRODUCTION TO ADVANCED PROCESSOR**
	Introduction to advanced architectures: ARM and SHARC, processor and memory organization and instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-Enabled systems, design example-Elevator controller.

TEXTBOOKS

1. Shibu K.V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition, 2009.
2. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill Education, 2nd Edition, 2011.
3. Andrew Sloss, Dominic Symes, Wright, "ARM System Developer's Guide Designing and Optimizing System Software", 1st Edition, 2004.

REFERENCE BOOKS:

1. Wayne Wolf, — Computers as Components, Principles of Embedded Computing Systems Design, Elsevier, 2 nd Edition, 2009
2. Dr. K. V. K. K. Prasad, — Embedded / Real-Time Systems: Concepts, Design & Programming, dreamtech publishers, 1 st Edition, 2003.
3. Frank Vahid, Tony Givargis, —Embedded System Design‖, John Wiley & Sons, 3 rd Edition, 2006
4. Lyla B Das, "Embedded Systems" , Pearson Education, 1st Edition, 2012.
5. David E. Simon, "An Embedded Software Primer", Addison-Wesley, 1st Edition, 1999.
6. Michael J.Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.

WEB REFERENCES:

1. https://www.smartzworld.com/notes/embedded-systems-es/
2. http://notes.specworld.in/embedded-systems-es/
3. http://education.uandistar.net/jntu-study-materials
4. http://www.nptelvideos.in/2012/11/embedded-systems.html

COURSE WEB PAGE:

1. https://lms.iare.ac.in/index?route=course/playercourseid = 228sectionid = 729lessonid = 7135

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	https://lms.iare.ac.in/index?route=course/details&courseid=228
CONTENT DELIVERY (THEORY)			
2	Definition of embedded system, embedded systems vs. general computing systems.	CO 1	T1-1.1
3	History of Embedded systems	CO 1	T1-1.
4	Complex systems and microprocessor, classification,major application areas.	CO 1	T1-1.3
5	The embedded system design process	CO 1	T2-1.4
6	Characteristics and quality attributes of embedded systems	CO 1	T2-1.5
7	Formalisms for system design, design examples.	CO1	R2-1.2
10	Introduction to embedded C,C looping structures.	CO 2	T3-1.3
11	Register allocation, Function calls, and pointer aliasing.	CO 2	T3-2.4
12	Structure arrangement, Bit fields, unaligned data and endianness.	CO 2	T3-2.5
13	Inline functions and inline assembly, portability issues.	CO 2	T3-2.6
14	Embedded systems programming in C, binding and running embedded C program in Keil IDE	CO 2	T3-2.7
15	Embedded C program in Keil IDE, dissecting the program, building the hardware	CO 2	T3-2.8
16	Basic techniques for reading and writing from I/O port pins, switch bounce	CO 2	T3-2.9
17	Applications: Switch bounce, LED interfacing.	CO 2	R2-3.1
18	Interfacing with keyboards, displays	CO 2	R2-3.2
19	D/A and A/D conversions, multiple interrupts.	CO 2	R2-3.3
20	Serial data communication using embedded C interfacing.	CO 2	R2-3.4
28	RTOS Fundamentals, Operating system basics, types of operating systems	CO 3	R2-3.5
29	Tasks and task states, process and threads	CO 3	R2-3.6
30	Multiprocessing and multitasking, how to choose an RTOS	CO 3	R3-3.7
31	Task scheduling, semaphores and queues	CO 3	R3-3.8
32	Hard real-time scheduling considerations, saving memory and power.	CO 3	R3-4.1

33	Task communication: Shared memory, message passing	CO 3	R3-4.1
34	Remote procedure call and sockets	CO 3	R3-4.2
35	Task synchronization: Task communication synchronization issues	CO 3	R3-4.2
36	Task synchronization techniques, device drivers.	CO 3	R3-4.3
37	Host and target machines	CO 4	R3-4.3
38	Linker for embedded software	CO 4	R3-4.4
39	Locators for embedded software	CO 4	R3-4.4
40	Getting embedded software into the target system	CO 4	R3-4.5
41	Debugging techniques: Testing on host machine	CO 4	R3-4.5
44	Debugging techniques using laboratory tools, an example system.	CO 4	R3-4.5
47	Introduction to advanced architectures: ARM	CO 5	T2-8.1
48	Introduction to advanced architectures: SHARC	CO 5	T2-8.1
49	Processor and memory organization	CO 5	T2-8.2
50	Instruction level parallelism	CO 5	T2-8.2
51	Networked embedded systems: Bus protocols	CO 6	T2-8.3
52	Networked embedded systems: I2C bus and CAN bus	CO 6	T2-8.3
53	Internet-Enabled systems	CO 6	T2-8.4
54	Design example-Elevator controller.	CO 6	T2-8.4
PROBLEM SOLVING/ CASE STUDIES			
8	BMW 850i brake and stability control system	CO 1	T2-1.4
9	Design example of model train controller	CO 1	T3-2.7
21	Embedded C program for Switch bounce	CO 2	R2-3.2
22	Embedded C program for LED interface	CO 2	R3-4.5
23	Embedded C program for Interfacing with keyboards	CO 2	T2-8.2
24	Embedded C program for Interfacing with displays	CO 2	T2-1.4
25	Embedded C program for 7 Segment Display Interfacing	CO 2	T3-2.7
26	Embedded C program for ADC Interfacing with 8051 microcontroller	CO 2	R2-3.2
27	Embedded C program for DAC Interfacing with 8051 microcontroller	CO 2	R3-4.5
45	Design of Digital camera	CO 4	T2-8.2
46	Design of Microwave oven	CO 4	T2-1.4
55	Design of Elevator controller	CO 6	T3-2.7
DISCUSSION OF DEFINITION AND TERMINOLOGY			
56	Embedded computing	CO 1	T1-1.3
57	Introduction to embedded c and applications	CO 2	T3-2.4
58	RTOS fundamentals and programming	CO 3	R3-4.2
59	Embedded software development tools	CO 4	R3-4.4
60	Introduction to advanced processors	CO 5, CO 6	T2-8.3
DISCUSSION OF QUESTION BANK			
61	Embedded computing	CO 1	T1-1.3

62	Introduction to embedded c and applications	CO 2	T3-2.4
63	RTOS fundamentals and programming	CO 3	R3-4.2
64	Embedded software development tools	CO 4	R3-4.4
65	Introduction to advanced processors	CO 5, CO 6	T2-8.3

Course Coordinator **HOD,ECE**
Mr. B.Brahmaiah, Assistant Professor

ANNEXURE - I

KEY ATTRIBUTES FOR ASSESSING PROGRAM OUTCOMES

PO Number	NBA Statement / Key Competencies Features (KCF)	No. of KCF's
PO 1	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems **(Engineering Knowledge).** Knowledge, understanding and application of 1. Scientific principles and methodology. 2. Mathematical principles. 3. Own and / or other engineering disciplines to integrate / support study of their own engineering discipline.	3
PO 2	Identify, formulate, review research literature, and analyse complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences (**Problem Analysis).** 1. Problem or opportunity identification 2. Problem statement and system definition 3. Problem formulation and abstraction 4. Information and data collection 5. Model translation 6. Validation 7. Experimental design 8. Solution development or experimentation / Implementation 9. Interpretation of results 10. Documentation	**10**

PO 3	Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations (**Design/Development of Solutions).** 1. Investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues 2. Understand customer and user needs and the importance of considerations such as aesthetics 3. Identify and manage cost drivers 4. Use creativity to establish innovative solutions 5. Ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal 6. Manage the design process and evaluate outcomes. 7. Knowledge and understanding of commercial and economic context of engineering processes 8. Knowledge of management techniques which may be used to achieve engineering objectives within that context 9. Understanding of the requirement for engineering activities to promote sustainable development 10. Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	**10**
PO 4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions (**Conduct Investigations of Complex Problems).** 1. Knowledge of characteristics of particular materials, equipment, processes, or products 2. Workshop and laboratory skills 3. Understanding of contexts in which engineering knowledge can be applied (example, operations and management, technology development, etc.) 4. Understanding use of technical literature and other information sources Awareness of nature of intellectual property and contractual issues 5. Understanding of appropriate codes of practice and industry standards 6. Awareness of quality issues 7. Ability to work with technical uncertainty 8. Understanding of engineering principles and the ability to apply them to analyse key engineering processes 9. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modeling techniques 10. Ability to apply quantitative methods and computer software relevant to their engineering discipline, in order to solve engineering problems 11. Understanding of and ability to apply a systems approach to engineering problems.	**11**

PO 5	Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations **(Modern Tool Usage).** 1. Computer software / simulation packages / diagnostic equipment / technical library resources / literature search tools.	**1**
PO 6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice (**The Engineer and Society).** 1. Knowledge and understanding of commercial and economic context of engineering processes 2. Knowledge of management techniques which may be used to achieve engineering objectives within that context 3. Understanding of the requirement for engineering activities to promote sustainable development 4. Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues 5. Understanding of the need for a high level of professional and ethical conduct in engineering.	**5**
PO 7	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development (**Environment and Sustainability).** Impact of the professional Engineering solutions (Not technical) 1. Socio economic 2. Political 3. Environmental	**3**
PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice (**Ethics).** 1. Comprises four components: ability to make informed ethical choices, knowledge of professional codes of ethics, evaluates the ethical dimensions of professional practice, and demonstrates ethical behavior. 2. Stood up for what they believed in 3. High degree of trust and integrity	**3**
PO 9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings (**Individual and Teamwork).** 1. Independence 2. Maturity – requiring only the achievement of goals to drive their performance 3. Self-direction (take a vaguely defined problem and systematically work to resolution) 4. Teams are used during the classroom periods, in the hands-on labs, and in the design projects. 5. Some teams change for eight-week industry oriented Mini-Project, and for the seventeen -week design project.	**12**

	6. Instruction on effective teamwork and project management is provided along with an appropriate textbook for reference 7. Teamwork is important not only for helping the students know their classmates but also in completing assignments. 8. Students also are responsible for evaluating each other's performance, which is then reflected in the final grade. 9. Subjective evidence from senior students shows that the friendships and teamwork extends into the Junior years, and for some of those students, the friendships continue into the workplace after graduation 10. Ability to work with all levels of people in an organization 11. Ability to get along with others 12. Demonstrated ability to work well with a team	
PO 10	Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (**Communication).** "Students should demonstrate the ability to communicate effectively in writing / Orally" 1. Clarity (Writing) 2. Grammar/Punctuation (Writing) 3. References (Writing) 4. Speaking Style (Oral) 5. Subject Matter (Oral)	**5**
PO 11	Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments (**Project Management and Finance).** 1. Scope Statement 2. Critical Success Factors 3. Deliverables 4. Work Breakdown Structure 5. Schedule 6. Budget 7. Quality 8. Human Resources Plan 9. Stakeholder List 10. Communication 11. Risk Register 12. Procurement Plan	**12**

PO 12	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change (**Life - Long Learning).** 1. Project management professional certification / MBA 2. Begin work on advanced degree 3. Keeping current in CSE and advanced engineering concepts 4. Personal continuing education efforts 5. Ongoing learning – stays up with industry trends/ new technology 6. Continued personal development 7. Have learned at least 2-3 new significant skills 8. Have taken up to 80 hours (2 weeks) training per year	**8**

KEY ATTRIBUTES FOR ASSESSING PROGRAM SPECIFIC OUTCOMES

PSO Number	NBA statement / Vital features (VF)	No. of VF's
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	**2**
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	**2**
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	**2**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**IMAGE PROCESSING**				
Course Code	AECC26				
Program	B.Tech				
Semester	V				
Course Type	Professional Elective				
Regulation	UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	0	3	-	-
Course Coordinator	D. Sreelakshmi, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSC02	I	Linear Algebra and Calculus

II COURSE OVERVIEW:

The primary objective of this course is to introduce the concept of image processing techniques as a precise digital component with mathematical and signals concepts, and study on various techniques in the creation of digital model of the image, enhancement of quality, image restoration and compression and color models. The course consists of a strong mathematical component to process in spatial and frequency domains on gray and color images.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Image Processing	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	✓	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
30	Remember
30	Understand
40	Apply
0	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz \Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Quiz \AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.The AAT chosen for this course is given in table.

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

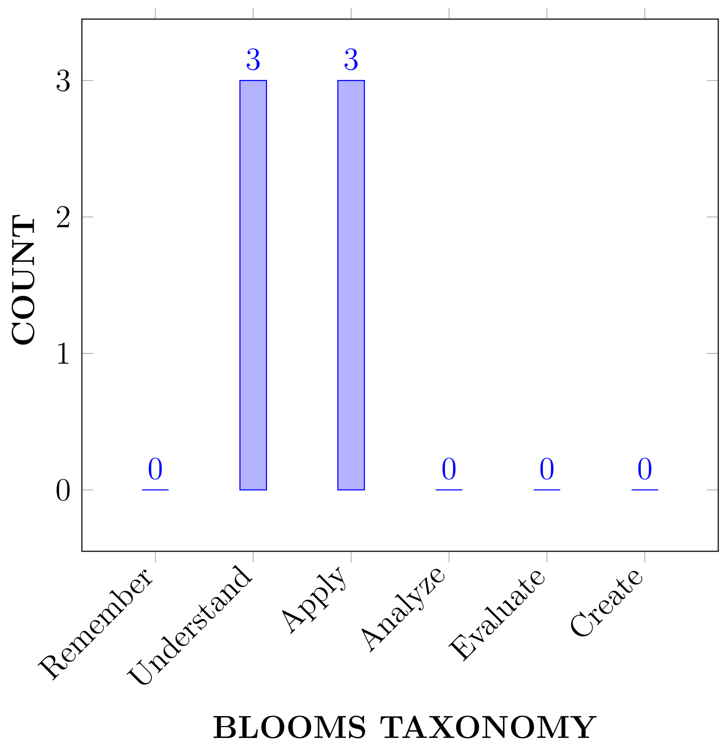
I	The fundamental concepts of digital image processing system and its components.
II	The image enhancement, segmentation and compression techniques in spatial and frequency domains.
III	The processing steps included in colour image model construction and enhancement.
IV	The algorithms used to solve image processing problems to meet design specifications of various applications like Industry, medicine and defence.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Interpret** the principles and terminology of digital image processing for describing the features of image.	Understand
CO 2	**Illustrate** mathematical tools used in image intensity transformations for quality enhancement.	Understand
CO 3	**Identify** image enhancement technique to improve the quality.	Apply
CO 4	**Apply** filters on spatial and frequency domains for restoring and reducing the noise in a given image.	Apply
CO 5	**Summarize** color models and transformation processing techniques for color image enhancement and compression	Understand
CO 6	**Apply** region based morphological operations and edge- based image segmentation techniques for detection of objects in images to remove the imperfections in the structure of the image.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Program Outcomes	
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	SEE / CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE / CIE / AAT
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	SEE / CIE / AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	SEE / CIE / AAT
PO 12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	3	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	2	CIE/Quiz /AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	✓	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 2	✓	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 3	✓	✓	✓	✓	-	-	-	-	-	✓	-	-	✓	-	-
CO 4	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	-	-
CO 5	✓	✓	-	-	-	-	-	-	-	✓	-	✓	✓	-	-
CO 6	✓	✓	-	-	-	-	-	-	-	✓	-	✓	✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Illustrate the principles of the Digital Image Processing terminology **(knowledge)** for understanding image and its representation, pixel, intensity, gray level, relationship between the pixels by applying the scientific and mathematical principles. **engineering science to complex engineering problems**	3

	PO 10	Effectively the Principles and terminology of ditgital image processing features **Speak and Write** with examples.	4
CO 2	PO 1	Illustrate the image formation model **(knowledge)** for understanding image and its representation with the help of **mathemetical and scientific principles.**	3
	PO 2	**Formulate and analyze (Problem analysis) complex Engineering problems** for image intensity transformation to improve the quality enhanement.	4
	PO 10	**Write and speak** the mathemetical tools used in image intensity transformations with examples.	4
CO 3	PO 1	Understand the image transform properties and its types using **Engineering Knowledge, Scientific and Mathematic principles.**	3
	PO 2	**Formulate and analyze** image transformation techniques for quality image.	5
	PO 3	Image enhancement techniques solving through **complex engineering problem** with appropriate **knowledge**considerations for quality image.	5
	PO 4	**Demonstrate** the image enhancement **analyze and interpretation and Ability to apply quantitative methods** in frequency domain processing technique to **provide valid** digital image.	7
	PO 10	**Write Subject Matter Effectively** on image enhancement techniques.	4
	PO 12	**Recognize the need for** the image enhancement techniques applications and **ability to improve** the enhancement algorithms in the broadest context of **technological advancements.**	3
	PSO 1	**Design** of quality image and its application relates in areas **Artificai Iintelligency,Machine learning and Algorithms.**	4
CO 4	PO 1	Distinguish the image restoration in the spatial and frequency domains **(knowledge)** to remove the noise present the image by applying the principles of **(mathematics, engineering science for complex engineering problems.**	2
	PO 2	Formulate and analyze **(Problem analysis) complex Engineering problems** for image restoration using first principles of **mathematics and Engineering sciences**	5
	PO 3	**Develop** spatial and frequency domain techniques **complex engineering problem with appropriate considerations** and **environmental considerations** for image restoration.	4

	PO 4	Understand the image restoration in the spatial and frequency domains **(knowledge)** methods **including design of experiments, analysis of complex problems.**	5
	PO 10	**Effective presentation and Speaking Style and write** on degradation models and noise sources for image restoration of digital images	4
	PO 12	**Recognize the need for** the image restoration in different image applications and **ability to improve** the degradation algorithms in the broadest context of **technological advancements.**	3
	PSO 1	Generation of noiseless images by filters on spatial and frequency domians are used in **Artificial Intelligence, Machine Learning and Algorithms.**	4
CO5	PO 1	**Illustrate the principles of an image find by using engineering** techniques for color image processing by using **mathematical methods.**	2
	PO 2	**Illustrate** the filter processing **model translation** for spatial domain and **formulate** the frequency domain filter.	2
	PO 3	**Develop** the restoration techniques **complex engineering problem with appropriate considerations** for noisy image .	5
	PO 10	**Effective presentation and Speaking Style** on color models and **write Subject Matter Effectively** on transformation processing techniques.	4
	PO 12	**Recognize the need for** the image segmentation in different image applications and **ability to improve** the enhancement algorithms in the broadest context of **technological advancements.**	3
	PSO 1	**Design** of color models and transformation processing techniques used in areas **Artificial Intelligence, Machine Learning and Algorithms.**	4
CO6	PO 1	**Understand** various morphological operations and implement on image using **engineering science and mathematical models.**	3
	PO 2	**Describe** region and boundaries using morphological operations to **analyze and identification** of the components in images using**principles of mathemetics**	5
	PO 10	**Present effectively** and **Clarity** morphological techniques and **write effectively subject matter** on identifying boundaries.	4
	PO 12	**Recognize the ability** of morphological techniques for **life-long learning in the broadest context of** image processing.	4

	PSO 1	Analysis of different Morphological operations and segmentations techniques used in **Artificial Intelligence, Machine Learning and Algorithms.**	4

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	12	6	2	2
CO 1	2	-	-	-	-	-	-	-	-	4	-	-	-	-	-
CO 2	2	4	-	-	-	-	-	-	-	4	-	-	-	-	-
CO 3	3	5	5	7	-	-	-	-	-	4	-	3	4	-	-
CO 4	2	5	4	4	-	-	-	-	-	4	-	3	4	-	-
CO 5	2	2	5	-	-	-	-	-	-	4	-	3	4	-	-
CO 6	3	5	-	-	-	-	-	-	-	4	-	3	4	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	66.6	-	-	-	-	-	-	-	-	80	-	-	-	-	-
CO 2	66.6	40	-	-	-	-	-	-	-	80	-	-	-	-	-
CO 3	100	50	50	63.3	-	-	-	-	-	80	-	25	66.6	-	-
CO 4	66.6	50	40	45.5	-	-	-	-	-	80	-	25	66.6	-	-
CO 5	66.6	20	50	-	-	-	-	-	-	80	-	25	66.6	-	-
CO 6	100	50	-	-	-	-	-	-	-	80	-	25	66.6	-	-

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, **0** being **no correlation**, **1** being the **low correlation**, **2** being **medium correlation** and **3** being **high correlation**.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -5 $< C \leq 40\%$ – Low/ Slight
2 - 40 % $< C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 2	3	1	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 3	3	2	2	3	-	-	-	-	-	3	-	1	3	-	-

CO 4	3	2	1	1	-	-	-	-	-	3	-	1	3	-	-
CO 5	3	1	2	-	-	-	-	-	-	3	-	1	3	-	-
CO 6	3	2	-	-	-	-	-	-	-	3	-	1	3	-	-
TOTAL	18	8	5	4	-	-	-	-	-	18	-	4	12	-	-
AVERAGE	3	1.6	1.67	2	-	-	-	-	-	3	-	1	3	-	-

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Assignments	✓
Seminars	-	Student Viva	-	Certification	-
Laboratory Practices	-	TechTalks	✓	Mini projects	-
Term Paper	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION**
	What is digital image processing, origins of digital image processing, examples of fields that use dip, fundamental steps in digital image processing, components of an image processing system; Digital image fundamentals: Elements of visual perception, a simple image formation model, basic concepts in sampling and quantization, representing digital images, spatial and gray-level resolution, zooming and shrinking digital images, some basic relationships between pixels, linear and nonlinear operations.
MODULE II	**IMAGE ENHANCEMENT IN SPATIAL DOMAIN**
	Some basic gray level transformations, histogram processing, enhancement using arithmetic/logic operations, basics of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods. Introduction to the fourier transform and the frequency domain, smoothing frequency domain filters, sharpening frequency domain filters, homomorphic filtering.
MODULE III	**IMAGE RESTORATION AND FILTERING**
	A model of the image degradation/restoration process, noise models, restoration in the presence of noise only spatial filtering, periodic noise reduction by frequency domain filtering. Linear position invariant degradations, estimating the degradation function, inverse filtering, minimum mean square error (wiener) filtering, constrained least square filtering, and geometric mean filter.

MODULE IV	**COLOR IMAGE PROCESSING**
	Color models, pseudo color image processing, basics of full-color image processing, color transformations, smoothing and sharpening, color segmentation, noise in color images, color image compression; Wavelets and multi resolution processing: Image pyramids, sub band coding, the haar transform, multi resolution expansions, wavelet transforms in one dimension, fast wavelet transform, wavelet transforms in two dimensions, wavelet packets; Fundamentals, image compression models, error-free (lossless) compression, lossy compression.
MODULE V	**MORPHOLOGICAL IMAGE PROCESSING**
	Preliminaries, dilation and erosion, opening and closing, the hit-or-miss transformation, some basic morphological algorithms; Image segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region-based segmentation.

TEXTBOOKS

1. Rafael C Gonzalez, Richard E. Woods, “Digital Image Processing”, PHI, 2nd Edition, 2005.

REFERENCE BOOKS:

1. K. Jain, “Fundamentals of Digital Image Processing”, Pearson, 3rd Edition, 2004.
2. Scott. E. Umbaugh, “Digital Image Processing and Analysis”, CRC Press, 2nd Edition, 2014
3. S. Jayaraman, S. Esakkirajan, T.Veerakumar, “Digital Image Processing”, McGraw-Hill Education. (India) Pvt. Ltd., 2013

WEB REFERENCES:

1. http://www.efunda.com/math
2. http://www.ocw.mit.edu/resource
3. http://www.Sosmath.com

COURSE WEB PAGE:

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO’s	Reference
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO’s to PO’s PSO’s and their attainments are discussed.		

CONTENT DELIVERY (THEORY)			
2-3	What is digital image processing, origins of digital image processing, examples of fields that use DIP	CO 1, CO 2	T1: 1.1-1.5 , R1:1.1-1.2
4-5	Fundamental steps in digital image processing	CO 1, CO 2	T1:2.1-2.4, R1:1.3-1.5
6-7	Components of an image processing system	CO 1, CO 2	T1:2.1-2.4, R1:1.3-1.5
8-9	Digital image fundamentals,Elements of visual perception	CO 1, CO 2	T1:2.1-2.4 R1:1.3-1.5
10	a simple image formation model	CO 1, CO 2	T1:2.1-2.4 R1:1.3-1.5
11-12	Basic concepts in sampling and quantization	CO 1, CO 2	T1:2.1-2.4, R1:1.3-1.5
13-15	Representing digital images, spatial and gray-level resolution	CO 2	T1:2.5-2.9, R1:1.6-1.7
16-17	Zooming and shrinking digital images	CO 1, CO 2	T1:2.5-2.9, R1:1.6-1.7
18-19	Some basic relationships between pixels	CO1, CO 2	T1:2.5-2.9, R1:1.6-1.7
20	Llinear and nonlinear operations.	CO 1,CO2	T1:2.5-2.9, R1:1.6-1.7
21-22	Some basic gray level transformations, histogram processing	CO 2,CO 3	T1: 3.1-3.3R1:7.3
23-24	Enhancement using arithmetic/logic operations	CO 2, CO 3	T1: 3.1-3.3, R1:7.3
25-26	Basics of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods.	CO 2, CO 3	T1:3.4-3.6, R1:7.4
27-28	Introduction to the fourier transform and the frequency domain, smoothing frequency domain filters,	CO2, CO 3	T1: 4.1-4.9, R1:7.5
29-31	sharpening frequency domain filters, homomorphic filtering	CO 3	T1: 4.1-4.9, R1:7.5
32	Image restoration: A model of the image degradation/restoration process	CO4	T1: 5.1-5.4, R1:8.2
33	noise models, restoration in the presence of noise only spatial filtering	CO4	T1: 5.1-5.4, R1:8.2
34	periodic noise reduction by frequency domain filtering	CO4	T1: 5.1-5.4, R1:8.2
35	Image filtering: Linear position invariant degradations, estimating the degradation function	CO4	T1:5.6-5.10, R1:8.3
34	inverse filtering, minimum mean square error (wiener) filtering	CO4	T1:5.6-5.10, R1:8.3
35-36	constrained least square filtering, and geometric mean filter.	CO 4	T1:5.6-5.10, R1:8.3
37-38	Color fundamentals: Color models, pseudo color image processing, basics of full-color image processing	CO5	T1:6.1-6.9, R1:3.7-3.11.

39	color transformations, smoothing and sharpening	CO5	T1:6.1-6.9, R1:3.7-3.11
40	color segmentation	CO5	T1:6.1-6.9, R1:3.7-3.11
41	noise in color images, color image compression	CO 5	T1:6.1-6.9, R1:3.7-3.11
42	Wavelets and multi resolution processing: Image pyramids, sub band coding	CO 5	T1:7.1-7.6, R1:5.9
43	the haar transform, multi resolution expansions	CO 5	T1:7.1-7.6, R1:5.9
44	wavelet transforms in one dimension, fast wavelet transform, wavelet transforms in two dimensions, wavelet packets.	CO 5	T1:7.1-7.6, R1:5.9
45-46	Image compression: Fundamentals, image compression models, error-free (lossless) compression, lossy compression	CO 5	T1: 8.1-8.2,R1:11.1-11.2
47-48	Morphological image processing: Preliminaries, dilation and erosion, opening and closing, the hit-or-miss transformation, some basic morphological algorithms.	CO 6	T1:9.1-9.5, R1:11.3-11.4
49-50	Image segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region-based segmentation.	CO 6	T1:10.1- 10.4, R1:11.5-11.6
PROBLEM SOLVING/ CASE STUDIES			
1	Problems on basic relationships between pixels	CO 1	T1:2.1-2.4, R1:1.3-1.5
2	Problems on linear and non linear operations	CO 1	T1:2.1-2.4, R1:1.3-1.5
3	Problems on Histogram processing	CO 2	T1: 3.1-3.3 ,R1:7.3
4	Problems on smoothing and sharping	CO 2	T1: 3.1-3.3, R1:7.3
5	Problems on filters	CO 3,CO 4	T1: 4.1-4.9, R1:7.5
6	Problems on Color models	CO5	T1:6.1-6.9 ,R1:3.7-3.11
7	Problems on wavelet transforms	CO3	T1:7.1-7.6 R1:5.9
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	What is image translation and scaling, image transfom, shriking of image,dynamic range and Gray level?	CO 1	T1:2.5-2.9, R1:1.6-1.7
2	Give an application of high pass filter, low pass filter, band pass filter	CO 2	T1:3.4-3.6, R1:7.4
3	Give a difference of image restoration and image enhancement	CO 3	T1: 5.1-5.4, R1:8.2
4	List the applications of color models.	CO4, CO 5	T1:6.1-6.9, R1:3.7-3.11
5	What are the three principle pattern arrangements?	CO 6	T1:9.1-9.5, R1:11.3-11.4

DISCUSSION ON QUESTION BANK			
1	Compare the linear and nonlinear operations with the help of mathematical tools.	CO 1	T1:2.5-2.9, R1:1.6-1.7
2	Apply full correlation image data and using the specified weighted filter for contrast enhancement.	CO 2	T1:3.4-3.6, R1:7.4
3	Obtain equations for butter worth, gaussian band reject filters and band pass filter	CO3,CO4	T1:5.6-5.10, R1:8.3
4	What are the applications of wavelet transforms in image processing? Discuss.	CO5	T1:7.1-7.6, R1:5.9
5	One category of image segmentation is referred to as edge-based segmentation. Describe how the first and second order derivatives can be used to detect edges, how they differ from each other, how they are affected by noise, and which filter masks can be used.	CO 6	T1:10.1- 10.4, R1:11.5-11.6

Course Coordinator **HOD,CSE**
Ms. D.Sreelakshmi, Assistant Professor

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COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Course Title	**OBJECT ORIENTED SOFTWARE DESIGN LABORATORY**				
Course Code	ACSC21				
Program	B.Tech				
Semester	V	CSE			
Course Type	CORE				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Ms. D. Rajani, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITC02	III	Object Oriented Programming with objects.

II COURSE OVERVIEW:

This Laboratory course introduces the Unified Modeling language for visualizing, specifying, constructing and documenting in preparing blueprint of a software intensive system. This lab covers Static and Dynamic aspects of the System with illustrations of Class,Object,Component, Deployment Use case, State chart, sequence, activity, collaboration Diagrams. These diagrams are used to create low level and high level design documents of the software system.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Object Oriented Analysis Design Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

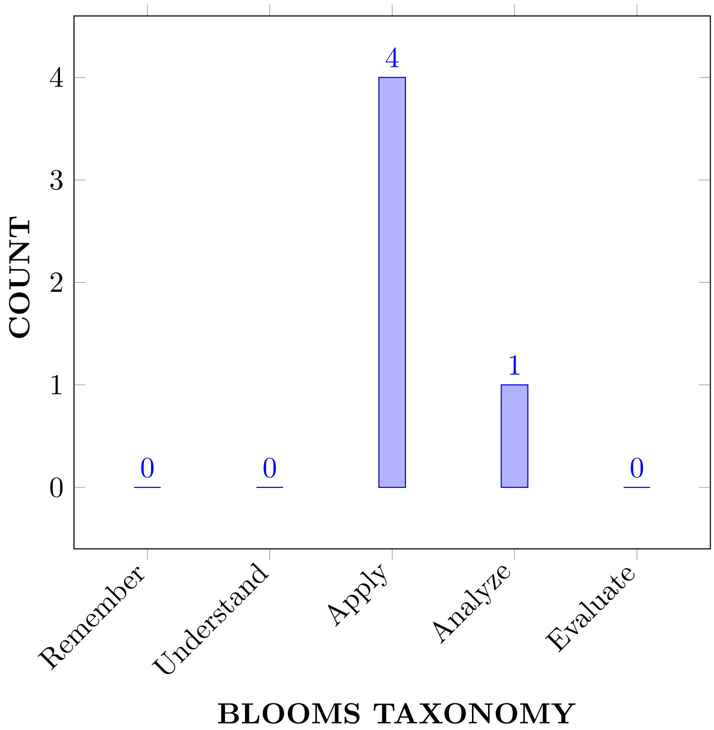
I	The need for requirement analysis in designing real time applications.
II	The implementation of Architectural views for different case studies.
III	The case studies for analyzing modeling techniques.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Analyze** features of software in view of software development process.	Analyze
CO 2	**Make use of** UML notations to represent requirements of the systems.	Apply
CO 3	**Develop** a design model of the software system with the help of UML structural diagrams.	Apply
CO 4	**Design** a behavioral model of the software system with the help of UML structural diagrams.	Apply
CO 5	**Develop** a design model for different real time applications.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	Lab Exercise, CIE, SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	Lab Exercise, CIE, SEE
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Lab Exercise, CIE, SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	1	Lab Exercise, CIE, SEE
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	1	SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 2	**F**ocus on implementing software reliability, network security and information retrieval systems	2	Lab Exercises
PSO 3	**M** ake use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies	2	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 2	**Analyze** features of software by **identifying, formulating, reviewing** complex engineering problems there by reaching to conclusion by following principles of SDLC.	6
	PO 3	**Design the solution** of software or system components by following designed guidelines.	10
	PO 4	**Identify the problems** and advantages for managing software requirement specifications.	5
	PSO 2	Compare process models, approaches and techniques to manage a given software development process by using the **mathematical principles and computer science Methodologies**	2
	PSO 3	**Formulate and Evaluate engineering concepts** to Design next-generation computer systems for modeling simple to complex engineering activities with understanding requirements and limitations of user.	2
CO 2	PO 2	Make use of UML notations to identify the **problem statement** and to define **model translation.**	2
	PO 3	Ensure the UML notation fits the purpose of all aspects of problem and **assists the design process** thereby achieving the engineering objectives.	3
	PO 4	Make use of building blocks for creating architectural view of system using UML by **communicating effectively to engineering community**	2
	PO 5	Make use of appropriate design techniques and **modern Engineering IT tools** for modelling the UML to represent complex engineering requirements.	1
	PSO 2	Design the software UML by identifying the **requirement activities like defining various problems, customer and user needs, cost effective and creative solutions, design process.**	2
	POS 3	Creation of UML to identify and **improve the software** eliability issues, analyze the data / Information.	2
CO 3	PO 2	**Understand** the given problem and **Design the software by making sure it fits for purpose for all aspects of the problem including**.	4
	PO 3	**Design** the software by making sure it fits for purpose for all aspects of the problem including**CASE tool** for modeling simple to complex engineering activities with understanding requirements and limitations of user.	1
	PO 4	**Understand** the given problem and **system definition, problem formulation, collecting data, modelling, solution development** for specifying structure and interaction of objects during runtime.	1

	PO 5	Translation of UML design notations that represent the requirement to actual implementation by **adopting techniques, resources and modern engineering tools..**	1
	PO 12	Classify the key issues in terms of **defining various problems, customer and user needs, cost effective and creative solutions, design process, economiccontext and management techniques.**	1
	PSO 2	Recognize the need and develop suitable building blocks using UML diagrams for **future advancement and lifelong learning.** eliability issues, analyze the data / Information.	1
	POS 3	Creation of UML to identify and **improve the software** eliability issues, analyze the data / Information.	2
CO 4	PO 2	Classify the key issues in terms of**defining various problems, customer and user needs, cost effective and creative solutions, design process.**	5
	PO 3	**Communicate** effectively in orally and written by comprehend and write effective **reports and design documentation**	6
	PO 4	Design solutions for simple and complex problems by **Defining problem, understand customer requirements, identifying** basic building blocks to draw UML diagrams.	1
	PO 5	Understand the **problem and develop solutions using different data technologies and document the results for interpretation.**	1
	PO 12	**Improve the software**reliability issues, analyze the data / Information.	1
	PSO 2	Identify the need and implement suitable building blocks using UML diagrams for **future advancement and lifelong learning.**	1
	PSO 3	Make use of **computational and advanced CASE tools** for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2
CO 5	PO 2	**Understand** the given problem and system **definition, problem formulation, collecting data, modelling, solution development** definition, problem formulation, collecting data, modelling, solution development and documentation for design solution by using advanced building blocks of UML.	5
	PO 3	**Design** the software by making sure it fits for purpose for all aspects of the problem including **production, operation and maintenance by applying innovative solutions.**	5

	PO 4	Understand the **experimental designs** and development of project analysis and development of software requirement Specifications.	5
	PO 5	Translation of UML design notations that represent the requirement to actual implementation by **adopting techniques, resources and modern engineering tools.**	1
	PSO 2	Creation of UML to identify and **improve the software**reliability issues, analyze the data / Information.	2
	PSO 3	Make use of modern computer tools to **identify the technical skills necessary of reliable engineering practices..**	2

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Course Outcomes	Program Outcomes					Program Specific Outcomes	
	PO 2	PO 3	PO 4	PO 5	PO12	PSO 2	PSO 3
CO1	3	3	3	-	-	2	2
CO2	2	2	2	1	-	2	2
CO3	3	3	1	1	3	1	2
CO4	3	3	2	2	1	1	2
CO5	3	3	3	3	2	2	2

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**REQUIREMENT DEVELOPMENT**
	problem statement Requirement engineering produces a specification of what a system should do. The intention of requirement engineering is to provide a clear definition of requirement of the systems. This phase is a very important phase because, if the customer requirements are not clearly understood, the ambiguity can get into the other phase of the development. To avoid such issues, requirement has to be elicited using the right elicitation techniques, to be analyzed effectively, specified clearly and verified thoroughly. All activities are collectively termed as requirement development activities. **solutions expected:**Identify the requirement development activities associated with each of the following scenarios: a. Joe is creating an online survey questionnaire for requesting user feedback on the desired features of the application to be developed. b. Mark is preparing a formal document which includes all of the desired features identified by the survey. c. Jack identified an incomplete requirement statement d. Jones is identifying all security related requirement and separating them from the performance related requirements e. Merlin a team member is sent to client to observe the business case and collect typical user requirements. g. Leo is team member is working on requirement and ensuring that requirement collected should not be vague and unclear. h. Lee is conducting a facilitated meeting with the stakeholder to capture the requirements. i. Amit a team member is distributing questionnaires to stack holder for gathering user requirements.
WEEK II	**ANALYSIS OF SYSTEM USING UML NOTATIONS**
	solutions expected: a. Demonstrate the Classes, relationships, common mechanisms. b.Illustrate the differences between functional and non-functional requirements.. c.Create SRS for Recruitment System
WEEK III	**DESIGN OF SYSTEM USING STRUCTURAL DIAGRAMS**
	problem statement: Design and illustrate the static part of the system using the UML structural diagrams (Object, and Class diagrams). **solutions expected:** a. Demonstrate differences between static and dynamic diagrams b. Develop a design model using Class diagrams library management c. Model a view using Object diagram for order management

WEEK IV	**DESIGN OF SYSTEM USING STRUCTURAL DIAGRAMS**
	problem statement: Design and illustrate the static part of the system using the UML structural diagrams (Component and Deployment diagrams). **solutions expected:** a. Demonstrate Components in Component diagram and Components in Deployment diagrams b. Develop a design model using Component and Deployment diagrams with an example c. Model a view using Component and Deployment diagrams for Hospital management system.
WEEK V	**DESIGN OF SYSTEM USING BEHAVIORAL DIAGRAMS**
	problem statement: Design and illustrate the static part of the system using the UML behavioral diagrams (Use Case, Sequential and Collaboration). **solutions expected:** a. Describe modelling techniques of Use case, Sequential and Collaboration diagrams b. Develop a design model using Use case, Sequential and Collaboration diagrams with an example. c. Model a view using Usecase diagrams for a parking lot
WEEK VI	**DESIGN OF SYSTEM USING BEHAVIORAL DIAGRAMS**
	problem statement: Design and illustrate the static part of the system using the UML behavioral diagrams (Activity and State chart). **solutions expected:** a. Describe in detail Activity and State chart diagrams b. Develop a design model using Activity and State chart diagrams with an example c. Model a view using Activity and state chart diagrams for movie ticket booking system.
WEEK VII	**EXAM REGISTRATION SYSTEM**
	Create a UML model for a system to perform the Exam Registration system **problem statement:**Exam Registration system is used in the effective dispatch of registration form to all of the students. This system adopts a comprehensive approach to minimize the manual work and schedule resources, time in a cogent manner. The core of the system is to get the online registration form (with details such as name, reg.no etc.,) filled by the student whose testament is verified for its genuineness by the Exam Registration System with respect to the already existing information in the database. **solutions expected:** a. Demonstrate modelling techniques of Class diagram for Exam Registration b. Develop a design model using Sequence diagrams for Exam Registration System c. Model a view using Collaboration diagram for Exam Registration System

WEEK VIII	**STOCK MAINTENANCE**
	Create a UML model for a system to perform stock maintenance **problem statement:**The stock maintenance system must take care of sales information of the company and must analyze the potential of the trade. It maintains the number of items that are added or removed. The salesperson initiates this Use case. The salesperson is allowed to update information and view the database. **solutions expected:** a. Develop a design model using Usecase diagrams for Stock Maintenance b. Develop a design model using Class diagrams for Stock Maintenance c. Model a view using using Sequence diagram for Stock Maintenanc
WEEK IX	**PASSPORT PROCESS**
	Create a UML model for a system to perform passport process **problem statement:**Passport Automation System is used in the effective dispatch of passport to all of the applicants .This system adopts a comprehensive approach to minimize the manual work and schedule resources, time in a cogent manner. The core of the system is to get the online registration form (with details such as name, address etc.,) filled by the applicants whose testament is verified for its genuineness by the Passport Automation System with respect to the already existing information in the database. **solutions expected:** a. Elaborate modelling techniques of Deployment diagrams b. Design model using Deployment diagrams for Passport Process c. Model a view using Activity diagram for Passport Process
WEEK X	**E-BOOK MANAGEMENT SYSTEM**
	Create a UML model for a system to perform E- book Management **problem statement:** An E, Book lends books and magazines to member, who is registered in the system. Also it handles the purchase of new titles for the Book Bank. Popular titles are brought into multiple copies. Old books and magazines are removed when they are out or date or poor in condition. A member can reserve a book or magazine that is not currently available in the book bank, so that when it is returned or purchased by the book bank, that person is notified. The book bank can easily create, replace and delete information about the tiles, members, loans and reservations from the system **solutions expected:** a. Define modelling techniques of Collaboration diagrams b. Design model using Deployment diagrams for E-book Management system c. Model a view using Use Case diagram for Passport Process

WEEK XI	**RECRUITMENT PROCESS**
	problem statement: The recruitment system allows the job seekers to enroll their names through the process of registration. The employee also can get the list of available candidates and shortlist for their company requirement. Once the applicant enrolls he receives an id, which helps him in further Correspondence. A fees amount is received from the job seekers for enrollment. This system makes the task of the job seeker easier rather than waiting in queue for enrollment. This also reduces the time consumption for both for the job seeker and employee.. **solutions expected:** a. Define modelling techniques of Sequence diagrams b. Design model using Sequence diagrams for Recruitment system process c.Model a view using Use Case diagram for Recruitment system process
WEEK XII	**ATM TRANSACTION**
	Problem Description: ATMs are omnipresent these days, at least in major cities and towns. It is an empowering technology, as one can withdraw or transfer money any time they want. Now the enrolment for bank accounts is on the rise, which will include many illiterate or old people also. Is the current ATM experience good enough for them to use it? How can the experience be enhanced for them? **solutions expected:** a. Demonstrate modelling techniques of Activity diagrams b. Design a model using Activity diagram for ATM Transaction c. Model a view using Use Case diagram for ATM Transaction
WEEK XIII	**CONFERENCE MANAGEMENT SYSTEM**
	Problem Description: The process of the candidates is to login the conference system and submit the paper through online. Then the reviewer reviews the paper and sends the acknowledgement to the candidate either paper selected or rejected. This process of on conference management system are described sequentially through following steps: • The candidate login to the conference management system. • The paper title is submitted. • The paper is been reviewed by the reviewer. • The reviewer sends acknowledgement to the candidate. • Based on the selection, the best candidate is selected. Finally, the candidate registers all details. **solutions expected:** a. Illustrate modelling techniques of Use Case diagrams b. Design a model using Use Case diagram for Conference Management System c. Model a view using using Sequence diagram for library Management System.

WEEK XIV	**PERFORMANCE TESTING**
	Problem Description: : Performance testing tests the non-functional requirements of the system. The different types of performance testing are load testing, stress testing, endurance testing and spike testing. **solutions expected:** 1. A space craft is expected to function for nearly 8 years in space. The orbit control system of the spacecraft is a real-time embedded system. Before the launch, the embedded software is to be tested to ensure that it is capable of working for 8 years in the space. Identify the suitable performance testing category to be carried out to ensure that the space craft will be functioning for 8 years in the space as required. 2. Global Education Centre (GEC) at Infosys Mysore provides the training for fresh entrants. GEC uses an automated tool for conducting objective type test for the trainees. At a time, a maximum of 2000 trainees are expected to take the test. Before the tool is deployed, testing of the tool was carried out to ensure that it is capable of supporting 2000 simultaneous users. Indicate the performance testing category? 3. A university uses its web-based portal for publishing the results of the students. When the results of an examination were announced on the website recently on a preplanned date, the web site crashed. Which type of performance testing should have been done during web-site development to avoid this unpleasant situation? 4. During unexpected terrorist attack, one of the popular websites crashed as many people logged into the web-site in a short span of time to know the consequences of terrorist attack and for immediate guidelines from the security personnel. After analyzing the situation, the maintenance team of that website came to know that it was the consequences of unexpected load on the system which had never happened previously. Which type of performance testing should have been done during web-site development to avoid this unpleasant situation?

TEXTBOOKS

1. Grady Booch, James Rumbaugh, Ivar Jacobson, —The Unified Modeling Language User Guide‖, Pearson Education, 2ndEdition, 2004.

REFERENCE BOOKS:

1. Craig Larman, —Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development‖, Pearson Education, 3rd Edition, 2005.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's
1	Requirement Development	CO 1, CO 2
2	Analysis of Systems Using UML Notations.	CO 1, CO 2
3	Design of system Using Structural Diagrams	CO 2, CO 4
4	Design of system Using Structural Diagrams	CO 2, CO 3
5	Design of System Using Behavioral Diagrams	CO 2, CO 3 CO 4

6	Design of System Using Behavioral Diagrams	CO 2, CO 4
7	Exam Registration System	CO 1, CO 2 ,CO 3 ,CO 4,CO 5
8	Stock Maintenance	CO 1, CO 2 ,CO 3 ,CO 4,CO 5
9	Passport Process	CO 1, CO 2 ,CO 3 ,CO 4,CO 5
10	E-Book Management Systems	CO 1, CO 2 ,CO 3 ,CO 4,CO 5
11	Recruitment Process	CO 1, CO 2 ,CO 3 ,CO 4,CO 5
12	Exam Registration System	CO 1, CO 2 ,CO 3 ,CO 4,CO 5
13	Conference Management System	CO 1, CO 2 ,CO 3 ,CO 4,CO 5
14	Performance Systems	CO 1, CO 2 ,CO 3 ,CO 4,CO 5

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	**Real time Online Transform** for embedded Systems considering non-functional aspects with rate-monotonic analysis.
2	Implementation of **Advanced relationships** and common mechanisms in real time applications.
3	**Reverse engineering:** Encourage students to implement model from a given input of source code.

Signature of Course Coordinator **HOD,CSE**
Ms .D.Rajani, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**Computer Science and Engineering**				
Course Title	**Web Application Development Laboratory**				
Course Code	AITC10				
Program	B. Tech				
Semester	V				
Course Type	Laboratory				
Regulation	UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	D.Durga Bhavani, Associate Professor				

I COURSE PRE-REQUISITES

Level	Course Code	Semester	Prerequisites
B.Tech	AITC02	III	Programming with Objects

II COURSE OVERVIEW

This course will give you the basic terminology and fundamental concepts to build modern web applications. This course introduces students to develop web applications. This course presents the basics of HTML5 and CSS3 for Web application development using HTML links and HTML forms. Introduction to the use of React router and its use in developing single-page applications, redux to develop React Redux powered applications, client-server communication and the use of REST API on the server side and react primitives render to native platform UI. This course will make the students to expose the front-end framework Bootstrap and to basic security mechanisms for server-side web application development.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Web Application Development Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component	**Laboratory**		**Total Marks**
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES

The students will try to learn:

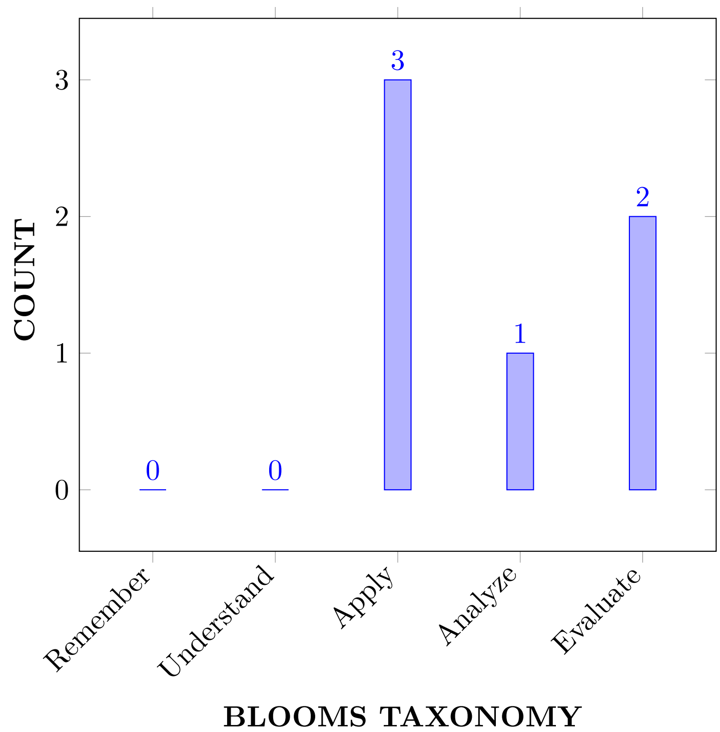
I	Programming concepts in Html 5, CSS 3, Bootstrap 4.
II	Developing skills of Web Applications user interactions using JavaScript (ES6+).
III	Web application Development Database with React and React Native.

VII COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Create a web pagewith different layouts including links by applying different styles and colors to produce specified outputs	Create
CO 2	Develop a responsive web application using bootstrap with background images, menus, with admin panel and tables.	Apply
CO 3	Develop interactive forms with different styles using javascript, CSS and bind data using AJAX.	Apply
CO 4	Develop single page applicationsusing react router and make use of react data libraries for data visualization in dynamic pages	Apply
CO 5	Adapt to design and develop web applications like drunken snake game and chat application with API responses using the industry's current models and architectures	Create
CO 6	Test for the database to extend the features and deployment of applications for solving problems that require interaction with a web server	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO 3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / SEE/ Lab Exercises
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE / SEE/ Lab Exercises
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	CIE / SEE/ Lab Exercises
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Lab Exercises
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	CIE / SEE/ Lab Exercises
PO 12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.	1	CIE / SEE/ Lab Exercises

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	3	CIE / SEE / Lab Exercises
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	3	CIE / SEE / Lab Exercises

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	CIE / SEE / Lab Exercises

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s)

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	-	✓
CO 2	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	✓	-
CO 3	-	-	✓	✓	✓	-	-	-	-	-	-		✓	✓	-
CO 4	-	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓	✓
CO 5	✓	✓	✓	-	-	-	-	-	-	-	-		✓	✓	-
CO 6	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT

Course Outcome	PO PSO	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Apply the **knowledge of science, engineering fundamentals,** and an engineering specialization to create a web page to produce specified outputs to the solutions of **complex engineering problems**.	3
	PO 2	**Identify** and **analyze complex engineering problems** reaching **substantiated conclusions** using first principles of **natural sciences**, and **engineering sciences** to create a web page to produce specified outputs	6
	PO 3	**Design solutions** using web pages for **complex engineering problems** and **design system components** that meet the specified needs with appropriate consideration for the **societal**, and **environmental considerations.**	5
	PO 12	**Use research-based knowledge** and **research methods** including **design of experiments**, **analysis** and **interpretation of data**, and **synthesis of the information** to produce specified outputs using web pages as per the requirements of the clients for different applications.	7
	PSO 1	Create a web page to **design search engines, web browsers,** and **knowledge discovery tools** to produce specified outputs	3
	PSO 3	Create web pages with the requirements of clients in **shipping real world software**, using **industry standard tools** and **collaboration techniques** to succeed in first job upon graduation in IT industry to produce specified outputs.	3

Course Outcome	PO PSO	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 2	PO 1	Apply the **knowledge of engineering fundamentals**, and an **engineering specialization** to the **solution of complex engineering problems** to develop a responsive web application.	3
	PO 2	**Identify** and **analyze complex engineering problems reaching substantiated conclusions** using first principles of **engineering sciences** to develop a responsive web application with background images, menus, with admin panel and tables.	5
	PO 3	**Design solutions** for **complex engineering problems** and **design system components** that meet the specified needs with appropriate consideration for **societal considerations** to develop a responsive web application.	4
	PO 4	**Use research-based knowledge** and **research methods** including **design of experiments, analysis** and **interpretation of data**, and **synthesis of the information** to provide valid conclusions to develop a responsive web applications.	6
	PO 12	Develop a responsive web applications for different **engineering problems** which is used in **life-long learning** in the **broadest context of technological change.**	4
	PSO 1	**Design search engines** and **web browsers** for responsive web application.	2
	PSO 2	Focus on mobile and web applications development and learn the **emerging technologies** and frameworks in demand with employers and **contemporary challenges** to develop a responsive web application.	2
CO 3	PO 3	**Develop** and **design solutions** with interactive forms in different styles using javascript for **complex engineering problems.**	3
	PO 4	**Use research-based knowledge** and **research methods** for **analysis** and **interpretation of data**, and **synthesis of the information** to p**rovide valid conclusions** using interactive forms with different styles using javascript, CSS and bind data using AJAX.	6
	PO 5	**Select and apply appropriate techniques, resources, and modern engineering and IT tools for modeling to complex engineering activities** with an understanding of the limitations to develop interactive forms with different styles using javascript, CSS and bind data using AJAX.	4
	PSO 1	**Design next-generation computer systems** with interactive forms using javascript in **search engines** and **web browsers** useful for **knowledge discovery tools.**	4
	PSO 2	Develop interactive forms with different styles using javascript, CSS and bind data using AJAX focussing on mobile and web applications development and learn the **emerging technologies** and frameworks in demand with **employers and contemporary challenges.**	2

Course Outcome	PO PSO	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 4	PO 2	**Identify** and **analyze complex engineering problems** reaching **substantiated conclusions** using first principles of **engineering sciences** to develop single page applications using react router and make use of react data libraries for data visualization in dynamic pages.	5
	PO 3	**Design solutions** for **complex engineering problems** to develop single page applications using react router and make use of react data libraries for data visualization in dynamic pages **that meet the specified needs.**	3
	PO 4	**Use research-based knowledge and research methods** including **design of experiments**, **analysis** and **interpretation of data**, and **synthesis of the information** to provide valid conclusions to develop single page applications for data visualization in dynamic pages.	6
	PO 5	**Select**, and **apply appropriate techniques**, **resources, and modern engineering and IT tools modeling to complex engineering activities** with an understanding of the limitations to develop single page applications using react router and make use of react data libraries for data visualization in dynamic pages.	5
	PO 12	**Recognize** the need for the **development** of single page applications for data visualization in dynamic pages in **life-long learning** in the **broadest context of technological change.**	4
	PSO 1	**Design** next-generation computer systems with **search engines** and **web browsers** to develop single page applications for data visualization in dynamic pages used for **knowledge discovery tools.**	4
	PSO 2	Develop single page applications focussing on mobile and web applications development and learn the **emerging technologies** and frameworks in demand with employers and **contemporary challenges.**	2
	PSO 3	Develop single page applications in **shipping real world software**, using **industry standard tools** and **collaboration techniques** will equip to secure and succeed in first job upon graduation in IT industry for data visualization in dynamic pages.	3
CO 5	PO 1	Apply the **knowledge of science**, **engineering fundamentals**, and an **engineering specialization** to the solution of **complex engineering problems** to adapt to design and develop web applications using the industry's current models and architectures.	3
	PO 2	**Identify** and **analyze complex engineering problems** reaching **substantiated conclusions** using first principles of **engineering sciences** to adapt to design and develop web applications using the industry's current models and architectures.	5
	PO 3	**Design solutions** for **complex engineering problems** and **design system components** to design and develop web applications using the industry's current models and architectures **that meet the specified needs.**	4

Course Outcome	PO PSO	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 1	**Design next-generation computer systems**, **search engines**, and **web browsers** to design and develop web applications using the industry's current models and architectures for **knowledge discovery tools.**	4
	PSO 2	To design and develop web applications like drunken snake game and chat application with API responses using the industry's current models and architectures focussing on mobile and web applications development and learn the **emerging technologies** and frameworks in demand with employers and **contemporary challenges.**	2
CO 6	PO 1	Apply the **knowledge of science**, **engineering fundamentals**, and an engineering specialization to the solution of **complex engineering problems** to extend the features and deployment of applications for solving problems that require interaction with a web server.	3
	PO 2	**Identify** and **analyze complex engineering problems** reaching substantiated conclusions using first principles of **engineering sciences** to extend the features and **deployment of applications** for solving problems that require interaction with a web server.	5
	PO 3	**Design solutions** for **complex engineering problems** and **design system components** that meet the specified needs to test for the database to extend the features and **deployment of applications** for solving problems that require interaction with a web server.	4
	PO 12	**Recognize the need for life-long learning** in the **broadest context of technological change** to extend the features and **deployment of applications** for **solving problems** that require interaction with a web server.	4
	PSO 1	**Design next-generation computer systems, search engines, web browsers**, and **knowledge discovery tools** to extend the features and deployment of applications for **solving problems** that require interaction with a web server.	5
	PSO 2	Focus on mobile and web applications development and learn the **emerging technologies** and frameworks in demand with employers and **contemporary challenges** to extend the features and deployment of applications for solving problems that require interaction with a web server.	2
	PSO 3	**Practical experience in shipping real world software**, using **industry standard tools** and **collaboration techniques** to extend the features and deployment of applications for solving problems that require interaction with a web server.	3

Note: For Key Attributes refer Annexures-I & II

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO / PSO) MAPPING

COURSE OUTCOMES	Program Outcomes												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	5	5	3	3	12	5	12	8	4	7	4
CO 1	3	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO 2	3	2	2	2	-	-	-	-	-	-	-	1	1	3	-
CO 3	-	-	1	2	4	-	-	-	-	-	-		3	3	-
CO 4	-	2	1	2	5	-	-	-	-	-	-	1	3	3	3
CO 5	3	2	2	-	-	-	-	-	-	-	-		3	3	-
CO 6	3	2	2	-	-	-	-	-	-	-	-	1	3	3	3

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO / PSO) MAPPING

COURSE OUTCOMES	Program Outcomes												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	5	5	3	3	12	5	12	8	4	7	4
CO 1	100	60	50	-	-	-	-	-	-	-	-	60	50	-	100
CO 2	100	50	40	55		-	-	-	-	-	-	33	33	100	-
CO 3	-	-	30	55	80	-	-	-	-	-	-	-	66	100	-
CO 4	-	50	30	55	100	-	-	-	-	-	-	33	66	100	100
CO 5	100	50	40	-	-	-	-	-	-	-	-	-	66	100	-
CO 6	100	50	40	-	-	-	-	-	-	-	-	33	84	100	100

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

COs and PO'S and COs and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	Program Outcomes												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	5	5	3	3	12	5	12	8	6	2	3
CO 1	3	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO 2	3	2	2	2	-	-	-	-	-	-	-	1	1	3	-
CO 3	-	-	1	2	3	-	-	-	-	-	-		3	3	-
CO 4	-	2	1	2	3	-	-	-	-	-	-	1	3	3	3
CO 5	3	2	2	-	-	-	-	-	-	-	-		3	3	-
CO 6	3	2	2	-	-	-	-	-	-	-	-	1	3	3	3

COURSE OUTCOMES	Program Outcomes												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
TOTAL	12	11	10	6	6	-	-	-	-	-	-	5	15	15	9
AVER-AGE	3	2	2	2	3	-	-	-	-	-	-	1	3	3	3

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
x	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

WEEK I	HTML LAYOUTS AND LINKS
	Problem Statement: Consider information related to any engineering college to design a webpage to display information in different layouts describing about the various departments in the college with different styles and colors with links to visit a specific department details. Solutions Expected: a) Develop a web application to control over different layouts. b) Create a webpage with HTML describing your department use paragraph and list tags. c) Apply various colors to suitable distinguish key words, also apply font styling like italics, underline and two other fonts to words you find appropriate, also use header tags. d) Create links on the words e.g. Wi-Fi‖ and LAN‖ to link them to Wikipedia pages
WEEK II	WEB APLLICATION DESIGN FORMATTING

	Problem Statement: You can design and create a responsive and innovative Registration Form using HTML and CSS skills. In this experiment, HTML helps to develop the form structure and includes various input fields for the users primary data, such as name, age, contact details and CSS will allow you to style the input fields and the complete form, such as field size, background colour, etc. Solutions Expected: a) Develop a web application with background banner image and navigation menus. b) Develop a web application with responsive images. c) Develop a web application using left menu. d) Develop setting to change the theme of entire web Application.
WEEK III	**INTRODUCTION TO RESPONSIVE INTERFACE USING BOOTSRAP**
	Problem Statement: In the era of Smartphones, websites should be responsive enough on the smaller screens.Intuitive navigation creates a better user experience for the website visitor. Create a simpler and customer oriented responsive web application using bootstrap 4 with Admin panel and tables. Solutions Expected: Write code for developing responsive web application with Admin panel and tables with static data.
WEEK IV	**BUIDLING INTERFACES USING JAVASCRIPT**
	Problem Statement: You can design and create a responsive and innovative Registration form Form to validate your HTML and CSS skills. In this experiment, HTML helps develop the form structure and includes various input fields for the users' primary data, such as name, age, contact details, etc and CSS will allow you to style the input fields and the complete form, such as field size, background color, etc. In addition, you can use JavaScript in the state to do validation duties such as character limit for input fields, email id format checking, etc. Solutions Expected: a) Set up the Folder Structure. b) Write the Model code and initialize the application. c) Implement the list objects and use cases. d) Implement the create object use case. e) Implement the update object use case.
WEEK V	**INTRODUCTION TO INTERATIVE FORMS AND AJAX DATA BINIDNG**

	Problem Statement: The popularity of client-side development with JavaScript and AJAX has exploded. The student should demonstrate and discusses a simple client order form, built using HTML, JavaScript, AJAX and CSS. Solutions Expected: a) Developing Web Page Styles using JavaScript and CSS, b) Develop Script interactive forms c) Data binding using Ajax

WEEK VI	REACT ENVIRONMENT SETUP
	Problem Statement: Set up an environment for the successful development of ReactJS application. Pre-requisite for ReactJS 1. NodeJS and NPM 2. React and React DOM 3. Webpack 4. Babel Solutions Expected: a) Setting up development environment. b) Integration with Existing Apps. c) Running on Device. d) Debugging e) Testing f) Write source code using Typescript.
WEEK VII	PROGRAMMING WITH REACT
	Problem Statement: Create a react scrollable view using React, which is an open-source front-end JS library for building interactive user interfaces.Use two types of components class and functional components to create UI components.Use class components to develop complex apps with React. React offered Hooks for functional components and made it possible to write the entire complex application using only functions as React components.React Scrollable List is a scrollable, high-performance list component for rendering large lists of items with React. Solutions Expected: a) Basics Interactive examples. b) Function Components and Class Components c) React Native Fundamental, Handling Text Input d) Using a scroll View, using List View. e) Platform Specific Code

WEEK VIII	**BUILD A DRUNKEN SNAKE GAME USING HOOKS**
	Problem Statement: The Drunken Snake game consists of 20 by 20 cells (This can be configured to make the playing grid bigger or smaller). There are no moving objects in the game. All grid cells are positioned stationary and based on the state of the game the respective cell is rendered as below. • Empty Cell • Snake Head • Snake Tail • Apple (food) Solutions Expected: a) Introduction and scaffolding the project. b) Components, Props and Styles. c) State and Lifecycle Events. d) Extended Game Functionality. e) Finishing up and Deployment
WEEK IX	**PHP SESSIONS BOX React FOR DATA VISUALIZATION**
	Problem Statement: React-scaffolder is a command line interface which brings smooth developer experience (DX) for React devs. react-scaffolder provides a better way to generate react projects.Use CSS Custom properties that dynamically update based on the change of state to modify JavaScript UI component properties as the variables state changes. Solutions Expected: a) Introduction and scaffolding the Project. b) Pages and Layout. c) Working with an API, CSS-in-JS. d) Dynamic Pages and React Hooks. e) Custom React Hooks, Dynamic CSS-in-JS. f) Finishing up and Deployment. g) Optimization and PWA.

WEEK X	**CHAT APPLICATION**
	Problem Statement: Adding Chat Rooms for your visitors is one of the most influential. An active private chat room on your website where your visitors can chat with each other adds extra charm to your site. They can use it for quick support, queries, and interact with each in the easiest way possible. Solutions Expected: a) Firebase Environment. Introduction and Scaffolding the project. b) Private and Public pages, Context API. c) Creating Side bar and Dashboard d) Creating and displaying Chat Rooms. e) Creating Layout for Chat page.
WEEK XI	**CHAT APPLICATION API RESPONSES**
	Problem Statement: Develop Chat API for Custom Messaging Apps. Build real-time chat messaging in less time. Rapidly ship in-app messaging with our highly reliable chat infrastructure. Improve your overall in-app conversion, engagement, and retention. Solutions Expected: a) Context API Problem-solution for the chat messages. b) Denormalization of the data to be stored in app. c) Displaying chat feed for Interactive UI along with Real time user presence.
WEEK XII	**DATABASES HANDLING**
	Problem Statement: A deployment is a place on your company's website that's enabled for Chat. Create deployments to implement Chat and control its functionality. Extend File and Audio Chat messages by • Navigating to your platform • Choose an active contact or click on the + to search for other contacts. • Select video, audio, or text and record or type your message. • If you want, attach a file or link out to an external page. • Click send. Solutions Expected: a) Role Based Access. b) Messages Likes and deletion. c) File and Audio Chat Messages d) Extended Chat Features and Deployment

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XIX COURSE PLAN

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	COs	Reference
1	HTML Layouts and Links	CO 1	T1: 2.2-2.3
2	Web Application Design Formatting	CO 1	R2: 3.4-3.9
3	Introduction To Responsive Interface Using Bootsrap	CO 2	R2: 4.1-4.3
4	Buiding Interfaces Using Javascript	CO 3	T2: 4.1-4.3
5	Introduction To Interative Forms and Ajax Data Binding	CO 3	T1: 4.4-4.7
6	React Environment Setup	CO 4	T1 8.1-8.4
7	Programming With React	CO 4	T1:10.2, 10.5
8	Build A Drunken Snake Game Using Hooks	CO 5	R4:8.1- 8.9
9	PHP Sessions Box React for Data Visualization	CO 4	R4:8.1- 8.9
10	Chat Application	CO 5	R4:8.1- 8.9
11	Chat Application API Responses	CO 5	R4:8.1- 8.9
12	Databases Handling	CO 6	R2:12.1- 12.16

XX EXPERIMENTS FOR ENHANCED LEARNING (EEL):

The course plan is meant as a guideline. Probably there may be changes.

S.No	Design Oriented Experiments	COs
1	Validate that the name and password must only contain letters and whitespace.	CO 3
2	Design a Webpage using advance HTML Form tags input–date, time, number, email, HTML5 Header and Footer, spell check and editable areas.	CO 1

3	Demonstrate Inline, Internal and External Style sheets using advanced CSS.	CO 3
4	Change a Content of webpage using AJAX. Perform Different Operations using JQUERY Selectors.	CO 3
5	Implementation of the iOS calculator built in React.	CO 1, CO 2, CO 3

Signature of Course Coordinator **HOD, CSE**
Dr.D.Durga Bhavani,
Associate Professor.

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	COMPUTER SCIENCE AND ENGINEERING				
Course Title	DATA MINING AND KNOWLEDGE DISCOVERY				
Course Code	ACIC01				
Program	B.Tech				
Semester	VI	CSE			
Course Type	Core				
Regulation	IARE-UG				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Ms. M Geetha Yadav, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITC05	IV	Database Management Systems
B.Tech	AHSC08	II	Probability and Statistics

II COURSE OVERVIEW:

Data mining refers to extracting or mining knowledge from large amounts of data. It emphasizes various techniques and algorithms used to explore, analyze and leverage data and turn it into valuable and actionable information. It includes data warehousing and data mining functionalities such as analytical processing, descriptive analysis, association mining, classification, clustering and outlier analysis. The techniques are used to tackle data centric applications in various domains such as financial analysis, telecommunication industry, intrusion detection, and complex data mining applications in stream, web, text, spatial and other scientific applications.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Data Mining and Knowledge Discovery	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
20 %	Understand
60 %	Apply
10 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE) and 10 marks for Quiz \Alternative Assessment Tool (AAT).

Component		**Marks**	**Total Marks**
CIE	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

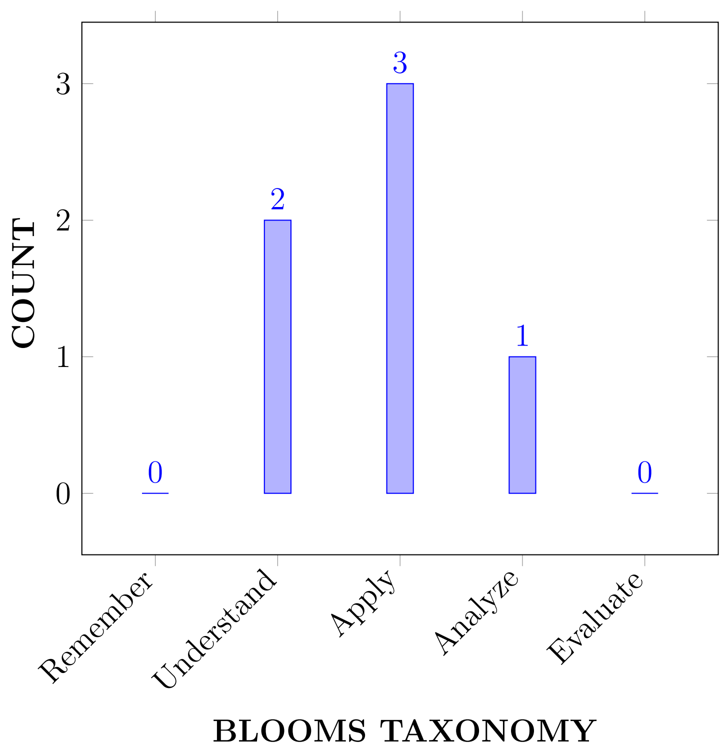
I	The scope and essentiality of data warehousing and mining.
II	The analysis of data, choosing relevant models and algorithms for respective applications.
III	The process and mining of complex data types such as streams, spatial, web and multimedia
IV	The research perspectives towards advances in data mining

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Relate** knowledge discovery in databases (KDD) process with the help of data warehouse fundamentals and data mining functionalities	Understand
CO 2	**Select** appropriate preprocessing techniques on real time data for usage of data mining algorithms	Apply
CO 3	**Apply** Apriori and FP growth methods on transaction data for frequent pattern mining	Apply
CO 4	**Choose** classification or clustering algorithm for building a classification or prediction model.	Apply
CO 5	**Infer** complex data models with respect to multimedia, streams, spatial and web mining	Understand
CO 6	**Examine** data mining algorithms for solving real world problems	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:**Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE/CIE/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	SEE/CIE/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	SEE/CIE/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	SEE/CIE/AAT
PO 5	Modern Tool Usage:Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	SEE/CIE/AAT
PO 10	Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	SEE/CIE/AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	SEE/CIE/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		**Strength**	**Proficiency Assessed by**
PSO 1	Understand, design and analyse computer programs in the areas related to Algorithms, System Software, Web design, Bigdata,Artificial Intelligence, Machine Learning and Networking.	3	SEE/CIE/ AAT
PSO 2	Focus on improving software reliability, network security and information retrieval systems	1	SEE/CIE/ AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	SEE/CIE/ AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s), PSO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**												**PSO'S**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	✓	-	✓	✓	-	✓
CO 3	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-	✓
CO 4	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	-	-	-	-	✓	-	-	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	-	-	-	-	✓	-	-	✓	✓	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	**PO'S PSO'S**	**Justification for mapping (Students will be able to)**	**No. of Key competencies matched.**
CO 1	PO 1	Explain the knowledge extraction Process by using mathematical ,computer science principles by integrating computer science knowledge.	3
CO 2	PO 1	Explain the data preprocessing techniques by applying mathematical principles and computer science principles by integrating computer science knowledge	3
	PO 2	Understand the data and apply the appropriate preprocessing techniques to solve real time data specific Problem statement and system definition, Problem formulation and abstraction , Information and data collection by including variant sizes of information and data collection, validation, experimental design, solution development and interpretation of results.	8

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	Communicate in written form by comprehending and writing effective reports and design documentation of prediction data model with the engineering community by having major focus on clarity on content with appropriate References and good Speaking style.	3
	PO 12	Recognize the need for advanced concepts in classification and prediction for developing data centric applications through continuing education efforts with ongoing learning stays up with industry trends/ new technology	1
	PSO 1	Develop data mining applications for specific problems by including huge volume of data and related to Algorithms, Artificial Intelligence, Machine Learning.	3
	PSO 2	Develop data mining applications for specific problems with a major focus on improving software reliability, network security and information retrieval systems.	1
	PSO 3	Develop applications by using modern computer tools related to create innovative career paths.	1
CO 3	PO 1	Select appropriate frequent pattern mining method for finding associations among attributes of data in transaction data using mathematical principles and computer science principles by integrating computer science knowledge.	3
	PO 2	Make use of Apriori or FP growth methods on transaction Problem statement and system definition, Problem formulation and abstraction , Information and data collection validation, experimental design, Solution development and interpretation of results.	6
	PO 3	Identify the appropriate model for various problems, by understanding customer and user needs, with cost effective and creative solutions by managing the design process, knowledge on economic context, management techniques for the requirement engineering activities to promote sustainable development.	8
	PSO 1	Make use of data mining concepts on huge volume data used to develop analytical solutions related to Machine Learning.	1
CO 4	PO 1	Develop a prediction model by extending classification model with the help of mathematical and scientific principles by integrating computer science knowledge.	3
	PO 2	Extend a created data model for specific prediction problems by including specific problems by including variant sizes of information and data collection, validation, experimental design, solution development,Implementation ,and interpretation of results and documentation is used as a sample data for new projects	8

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	Develop a data model by investigating and defining various problems, understanding customer and user needs, with cost effective and creative solutions with variant algorithms by managing the design process, knowledge on economic context, management techniques.	7
	PO 4	Develop a prediction and classification data model with laboratory skills, technical literature and quality issues to Identify, classify and describe the performance of systems through analytical methodsfor quantitative methodsand technical uncertainty	8
	PO 5	Make use of software / libraries for developing prediction model	1
	PO 10	Communicate effectively in orally and written by comprehend and write effective reports and design documentation and presentations on data exploration with the engineering community by having major focus on clarity on **content, Grammar/Punctuation, appropriate References, good Speaking style and depth in subject matter.**	5
	PO 12	Recognize the need for **advanced concepts** in big data technologies for developing applications through **continuing education efforts with ongoing learning** – stays up with industry trends/ new technology and continued personal development in the broadest context of technological change.	5
	PSO 1	Develop data mining applications for specific problems by including huge volume of data and related to Algorithms, Artificial Intelligence, Machine Learning	3
	PSO 2	Develop data mining applications for specific problems with a major focus on improving software reliability, network security and information retrieval systems.	1
	PSO 3	Develop applications by using modern computer tools related to create innovative career paths	1
. CO 5	PO 1	Select any data models with respect to multimedia, streams, spatial and web mining using mathematical principles and computer science principles by integrating computer science knowledge.	3
	PO 2	Make use of spatial and web mining methods on transaction data collection, validation, experimental design, Solution development and interpretation of results.	5
	PO 3	Select appropriate frequent pattern mining methodfor investigating and defining various problems, understanding customer and user needs, with cost effective and creative solutions with variant algorithms by managing the design process, knowledge on economic context, management techniques.	8

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 4	Develop a text based model with laboratory skills, technical literature and quality issues to Identify, classify and describe the performance of systems through analytical methodsfor quantitative methodsand technical uncertainty	7
	PO 5	Make use of software / libraries for finding text based and web based mining	1
	PO 10	Communicate in written form by comprehending and writing effective reports and design documentation of multimedia data model with the engineering community by having major focus on clarity on content	1
	PSO 1	Explain the complex data models used to process and querying the data in the areas related to Algorithms, Artificial Intelligence, Machine Learning	3
	PSO 2	Develop applications using data mining concepts with a major focus on improving software reliability, network securityand information retrieval systems.	1
	PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies	1
CO 6	PO 1	Understand the data mining model and examine the accuracy of the model by applying mathematical and scientific principles by integrating computer science knowledge.	3
	PO 2	Extend a created data model for specific real time problems by including specific problems by including variant sizes of information and data collection, validation, experimental design, solution development,Implementation ,and interpretation of results and documentation is used as a sample data for new projects	8
	PO 3	Develop a real time model by investigating and defining various problems, understanding customer and user needs, with variant algorithms by managing the design process, knowledge on economic context, management techniques	6
	PO 4	Develop a data model with laboratory skills, technical literature and quality issues to Identify, classify and describe the performance of systems through analytical methods	6
	PO 5	Make use of software / libraries for developing mining model.	1
	PO 10	Communicate in orally form by comprehending and writing effective reports and design documentation data mining applications with the engineering community by having major focus content with good Speaking style.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 1	Categorize various data mining concepts in the areas related to Algorithms, Artificial Intelligence, Machine Learning.	3
	PSO 2	Develop applications using data mining concepts with a major focus on improving software reliability, network securityand information retrieval systems.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	3	8	-	-	-	-	-	-	-	1	-	2	3	-	2
CO 3	3	6	8	-	-	-	-	-	-	-	-	-	-	-	1
CO 4	3	8	7	8	1	-	-	-	-	3	-	1	3	1	1
CO 5	3	5	8	7	1	-	-	-	-	1	-	-	3	1	1
CO 6	3	8	6	6	1	-	-	-	-	1	-		3	1	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	100	80	-	-	-	-	-	-	-	20	-	16.6	50	-	100
CO 3	100	60	80	-	-	-	-	-	-	-	-	-	-	-	50
CO 4	100	80	70	72.7	100	-	-	-	-	60	-	8.3	50	50	50
CO 5	100	50	80	63.6	100	-	-	-	-	20	-	-	50	50	50
CO 6	100	80	60	54.5	100	-	-	-	-	20	-		50	50	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq$ C$\leq$ 5% – No correlation
1 -5 <C$\leq$ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% $\leq$ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	3	3	-	-	-	-	-	-	-	1	-	1	2	-	3
CO 3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	3	-	-	-	-	2	1		2	2	1
CO 5	3	2	3	3	3	-	-	-	-	1	-	-	2	2	2
CO 6	3	3	2	2	3	-	-	-	-	1	-	-	2	2	-
TOTAL	18	13	11	8	9	-	-	-	-	5	-	2	8	6	8
AVERAGE	3	2.6	2.75	2.6	3.0	-	-	-	-	1.25	-	1	2.0	2.0	2.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	-	Open Ended Experiments	-
Assignments	-				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**KNOWLEDGE DISCOVARY**
	Data Mining definition, knowledge discovery in data (KDD), kinds of data can be mined, kinds of patterns / data mining functionalities, technologies, applications, issues in data mining. data objects and attribute types, basic statistical descriptions of data, data visualization, measuring data similarity and dissimilarity.
MODULE II	**DATA PREPROCESSING**
	Data Preprocessing:Data quality, major tasks in data preprocessing, data cleaning, data integration and transformation, data reduction, data discretization.

MODULE III	**DATA WAREHOUSING AND ONLINE ANALYTICAL PROCESSING**
	Data warehouse concepts, differences between operational database systems and data warehouses, a multitiered architecture; Data Warehouse Models:Enterprise warehouse, data mart, and virtual warehouse, extraction, transformation, and loading, metadata repository, a multidimensional data model; Schemas for Multidimensional Data Models:Stars, snowflakes, and fact constellations, dimensions, measures, OLAP operations, a starnet query model for querying multidimensional databases. Business Analysis framework for data warehouse design, data warehouse design process, data warehouse implementation, indexing OLAP data, OLAP server architectures, data generalization by attribute, oriented induction
MODULE IV	**MINING FREQUENT PATTERNS AND CLASSIFICATION**
	Market basket analysis, frequent itemsets, closed itemsets, and association rules, frequent itemset mining methods; Apriori algorithm, generating association rules from frequent itemsets, improving the efficiency of Apriori PatternGrowth Approach. Classification:Basic concepts, decision tree induction, Bayesian belief networks, classification by back propagation, support vector machines, classification using frequent patterns, lazy learners, other classification methods, model evaluation and selection, techniques to improve classification accuracy.
MODULE V	**CLUSTERING AND RESEARCH FRONTIERS**
	Cluster Analysis, Partitioning methods, hierarchical methods, density-based methods, grid based methods, evaluation of clustering. Mining Complex Types of Data:Mining Sequence Data:Time-series, symbolic sequences, and biological sequences, mining graphs and networks.

TEXTBOOKS

1. Jiawei Han, Michelin Kamber, "Data Mining-Concepts and techniques", Morgan Kaufmann Publishers, Elsevier, 2nd Edition, 2006
2. Alex Berson, Stephen J.Smith, "Data warehousing Data mining and OLAP", Tata McGraw- Hill, 2nd Edition, 2007

REFERENCE BOOKS:

1. Arum K Pujari, "Data Mining Techniques", 3rd Edition, Universities Press, 2005
2. Pualraj Ponnaiah, Wiley, "Data Warehousing Fundamentals", Student Edition, 2004
3. Ralph Kimball, Wiley, "The Data Warehouse Life Cycle Toolkit", Student Edition, 2006.
4. Vikram Pudi, P Radha Krishna, —Data Mining, Oxford University, 1st Edition, 2007.

WEB REFERENCES:

1. http://www.anderson.ucla.edu
2. https://www.smartzworld.com
3. http://iiscs.wssu.edu

COURSE WEB PAGE:

https://www.youtube.com/watch?v=IlD7-ipjQUk

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1:4.1
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO's to PO's PSO's and their attainments are discussed.		
CONTENT DELIVERY (THEORY)			
1	Data Mining:Introduction, Definition	CO1	T1:1.1-1.7
2	KDD Process	CO1	T1:1.1-1.7
3	Kinds of data can be mined	CO1	T1:1.1-1.7
4	Kinds of patterns/data functionalities	CO1	T1:1.1-1.7
5	Technologies, Applications	CO1	T1:1.1-1.7
6	Issues in data mining	CO1	T1:1.1-1.7
7	Data objects and attribute types	CO1	T1:1.1-1.7
8	Basic statistical descriptions of data, Data visualization	CO1	T1:1.1-1.7
9	Measuring data similarity and dissimlarity	CO1	T1:1.1-1.7
10	Data PreProcessing:data quality	CO2	T1:2.1-2.5
11	Major tasks in dat preprocessing, Data Cleaning	CO2	T1:2.1-2.5
12	Techniques to improve Classification Accuracy	CO2	T1:2.1-2.5
13	Data integration and transformation	CO2	T1:2.1-2.5
14	Data reduction, Data Discretization .	CO2	T1:2.3-2.4
15	Introduction to Data warehouse	CO3	T1:3.1
16	Difference between operational database systems and datawarehouses	CO3	T1:3.1
17	Data warehouse architecture- A three tier Data warehouse architecture, Types of OLAP servers	CO3	T1:3.3
18	Data warehouse Implementation	CO3	T1:3.3
19	Data Marts, Differences between OLAT and OLTP.	CO3	T1:3.3
20	Multi-dimensional data model:Star Schema	CO3	T1:3.2
21	Multi-dimensional data model: Snow Flake Schema	CO3	T1:3.2
22	Fact Consultation, Fact Table, Dimension Table	CO3	T1:3.2
23	OLAP Cube and OLAP Operations	CO3	T1:3.4-3.5
24	OLAP Server Architecture-ROLAP	CO3	T1:3.4-3.5
25	OLAP Server Architecture- MOLAP	CO3	T1:3.4-3.5
26	OLAP Server Architecture- HOLAP.	CO3	T1:3.4-3.5
27	Data ware house models, Data warehouse design process	CO4	T1:3.4-3.5
28	Indexing of OLAP data, Data generalization by attribute	CO4	T1:3.4-3.5
29	Oriented induction, Market basket analysis	CO4	T1:3.4-3.5

30	Frequent item sets	CO4	T1:5.3
31	The APRIORI Algorithm, Association rule generation	CO4	T1:5.2
32	Frequent itemset mininig methods	CO4	T1:5.2.2
33	Improving the efficiency of apriori pattern growth Algorithm.	CO4	T1:5.2.2
34	Classification and prediction, Basic concepts	CO4	T1:6.1-6.2
35	Classification by Decision Tree Induction	CO5	T1:6.1-6.2
36	Classification by back propagation	CO5	T1:6.5
37	Support vector machine	CO5	T1:3.4-3.5
38	Classification using frequent patterns	CO5	T1:6.6
39	Lazy learners	CO5	T1:3.4-3.5
40	Other Classification Methods	CO6	T1:6.6
41	Model evaluation and selection	CO6	T1:3.4-3.5
42	Grid based methods, Hierarchical methods	CO6	T1:7.6
43	Evaluation of clustering, Types of Data:Data Objects	CO6	T1:7.11
44	Mining Spatial Databases, Mining Multimedia Databases, Mining Time-Series and Sequence Data	CO6	T1:7.11
45	Symboloc sequences, Biological sequences, Mining graphs and networks, Example Systems	CO6	T1:7.11
PROBLEM SOLVING/ CASE STUDIES			
1	Problems on Hierarchical and lattice structures of attributes in warehouse dimensions for location and time.	CO 3	T1:1.1-1.7
2	Problems on Multi-dimensional modelling.	CO 3	T1:1.1-1.7
3	Problems on Analytical processing.	CO 3	T1:1.1-1.7
4	Problems on Implementation techniques. of data warehouse.	CO 3	T1:1.1-1.7
5	Problems on OLAP operations on multi-dimensional data cube. at possible levels.	CO 3	T1:1.1-1.7
6	Problems on preprocessing techniques and relate to the given data to perform summarization and visualization.	CO 3	T1:1.1-1.7
7	Problems on applications of frequent pattern mining methods.	CO 4	T1:1.1-1.7
8	Problems on frequent item set methods and pattern growth approach.	CO 4	T1:3.4-3.5
9	Problems on Basic Classification Methods.	CO 3	R2:7.5
10	Problems on operations of OLAP.	CO 3	T1:1.1-1.7
11	Problems on K-means Clustering.	CO 3	R2:7.5
12	Problems on K medoid clustering.	CO 3	R2:7.5
13	Problems on normalization.	CO 3	T1:1.1-1.7
14	Problems on Back propogation method.	CO 3	T1:6.6
15	Problems on Bayesian networks.	CO 3	T1:6.7
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Definitions on Data mining	CO 1	T1:1.2
2	Definitions on Data Preprocessing	CO 2	T1:1.6
3	Definitions on Online analytical processing	CO3, CO4	T1:8,9
4	Definitions on Classification	CO 5	T1:9.1
5	Definitions on Clustering	CO 6	T1:10,11

DISCUSSION OF QUESTION BANK			
1	Classification of data mining systems	CO 1	T1:1.2
2	Data preprocessing	CO 2	T1:1.5
3	Data warehouse architecture	CO3, CO4	T1:8,9
4	Issues Regarding Classification	CO 5	T1:9.1
5	Clustering Methods	CO6	T1:10,11

Signature of Course Coordinator **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**SOFTWARE QUALITY ASSURANCE AND TESTING**				
Course Code	ACIC02				
Program	B.Tech				
Semester	VI				
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms. K Rashmi, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITB17	V	Object Oriented Software Engineering

II COURSE OVERVIEW:

Software Quality and Testing refers to practical approach to software testing as a sub-discipline of software engineering. It introduces software quality concepts, standards, measurements, and practices that support the production of quality software. It offers a solid foundation in testing fundamentals including test case design, test management, and test measurement strategies, which improve the effectiveness of software test processes.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Software Quality Assurance and Testing	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	x	Chalk & Talk	x	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
20 %	Understand
60 %	Apply
10 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

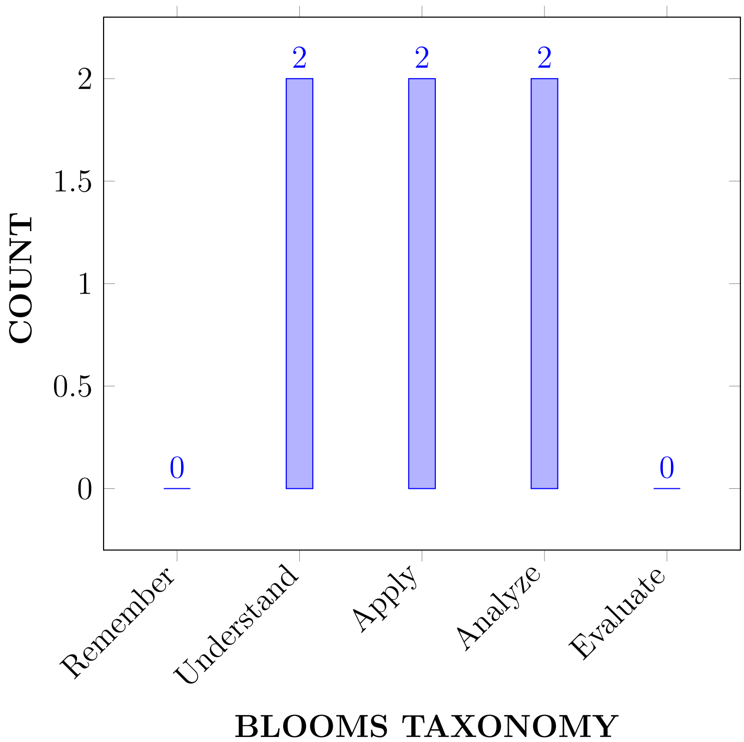
I	The software testing and quality assurance as a fundamental component of software life cycle
II	Describe fundamental concepts of software quality assurance.
III	How to use software quality tools and analyze their effectiveness
IV	The quality management, assurance, and quality standard to software system

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** the power of wide variety of testing techniques in developing qualitative software as per customer needs	Understand
CO 2	**Make use of** various system testing strategies at various levels for analyzing likelihood of faults and generating defect free software product	Apply
CO 3	**Utilize** Testing plans and procedures for developing effective software product	Apply
CO 4	**Analyze** automated Testing models for evaluating correctness of real time software systems	Analyze
CO 5	**Illustrate** the importance of standards in the quality management process and their impact on the final product	Understand
CO 6	**Inspect** Quality assurance tools techniques to manage Risk and assess quality of software developed for engineering applications	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations

Program Outcomes	
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	CIE/Quiz/AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	CIE/Quiz/AAT
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	CIE/Quiz/AAT
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	3	CIE/Quiz/AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	CIE/Quiz/AAT
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	3	CIE/Quiz/AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	2	Quiz
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	2	Quiz
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	CIE/Quiz/ AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		✓	✓	-
CO 2	-	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	✓	-
CO 3	-	✓	✓	-	-	-	-	-	✓	-	-	-	✓	-	-
CO 4	✓	-	-	-	✓	-	✓	-	-	-	-	-	-	✓	✓
CO 5	✓	-	✓	-	✓	-	-	-	-	✓	✓	-	✓	✓	-
CO 6	-	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	✓	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Explain the knowledge extraction Process by using Testing Techniques to gain Quality Software Products by integrating computer science knowledge	3
	PSO 1	Select appropriate preprocessing techniques on real time testing models for usage of software devlopment to design next-generation computer systems, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3
	PSO 2	Infer complex testing stratagies with respect to multimedia, streams, spatial and web mining in demand with employers and contemporary challenges.	1
CO 2	PO 2	Explain the Testing Strategies by applying mathematical principles and computer science principles by integrating computer science knowledge	3
	PO 3	Understand the Requierments and apply the appropriate preprocessing techniques to solve real time faults and generate defect free software product, validation, experimental design, solution development and interpretation as a results.	8
	PO 4	Communicate in written form by comprehending and writing effective reports and design documentation of prediction data model with the engineering community by having major focus on clarity on content with appropriate References and good Speaking style	1
	PO 5	Recognize the need for advanced concepts in classification and prediction for developing data centric applications through continuing education efforts with ongoing learning stays up with industry trends/ new technology	1
	PO 11	Understand the Complex Problem Solving in Devlopment of an End Product to manage projects and in multidisciplinary environments.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 12	Recognize the need for advanced concepts in classification and prediction for developing End product centric applications through continuing education efforts with ongoing learning stays up with industry trends/ new technology	1
	PSO 1	Select appropriate preprocessing techniques on real time testing models for usage of software devlopment to design next-generation computer systems, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools..	3
	PSO 2	Infer complex testing stratagies with respect to multimedia, streams, spatial and web mining in demand with employers and contemporary challenges.	1
CO 3	PO 2	Select appropriate testing plans to analyze solutions for complex engineering problems reaching substantiated conclusions using first principles of mathematics	3
	PO 3	Make use of Apriori or FP growth methods on transaction Problem statement and system definition, Problem formulation and abstraction , Information and data collection validation, experimental design, Solution development and interpretation of results	6
	PSO 1	Apply Apriori and FP growth methods on transaction data for frequent pattern mining in shipping real world software upon graduation in IT industry.	3
CO 4	PO 1	Develop a automated testing models and procedures with the help of mathematical and scientific principles by integrating computer science knowledge	3
	PO 5	Extend a created testing model for specific test plans by including specific problems and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction.	8
	PO 7	Develop a testing model by investigating and defining various problems, understanding customer and user needs, with cost effective and creative solutions with variant algorithms by managing the design process, knowledge on economic context, management techniques	7
	PSO 2	Choose classification testing for building sofware model to learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	1
	PSO 3	Choose classification or clustering algorithm for building classification or prediction model in shipping real world software.	1
CO 5	PO 1	Select any standards in the quality improving process using computer science principles by integrating computer science knowledge.	3
	PO 3	Make use of quality standards on transaction data collection, validation, experimental design, Solution development and interpretation of results.	5

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 5	Select appropriate software quality standerds for investigating and defining various problems, understanding customer and user needs, with cost effective and creative solutions with variant algorithms by managing the design process, knowledge on economic context, management techniques.	8
	PO 10	Communicate in written form by comprehending and writing effective reports and design documentation of multimedia data model with the engineering community by having major focus on clarity on content	1
	PSO 1	Infer quality models with respect to multimedia, streams, spatial for design next-generation computer systems, search engines and knowledge discovery tools.	1
	PSO 3	Infer complex data models with respect to multimedia, streams, spatial and web mining in shipping real world software, using industry standard tools.	1
CO 6	PO 2	Understand the Quality assurance tools, techniques to manage Risk and assess quality of software by applying mathematical and scientific principles by integrating computer science knowledge.	3
	PO 3	Extend a created quality assurance techniques for specific real time problems by including specific problems by including variant sizes of information and data collection, validation, experimental design, solution development,Implementation ,and interpretation of results and documentation is used as a sample data for new projects	8
	PO 4	Develop a real time model by investigating and defining various problems, understanding customer and user needs, with variant algorithms by managing the design process, knowledge on economic context, management techniques	6
	PO 5	Develop a software quality model with laboratory skills, technical literature and quality issues to Identify, classify and describe the performance of systems through analytical methods	6
	PO 11	Make use of software / libraries for developing quality model.	1
	PO 12	Communicate in orally form by comprehending and writing effective reports and design documentation software applications with the engineering community by having major focus content with good Speaking style.	1
	PSO 1	Examine Quality metric for design next-generation computer systems to solve real world problems, soft computing and intelligent systems and knowledge discovery tools.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 2	Examine quality strategies for solving real world problems for the development of applications in demand with employers and contemporary challenges.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	3	8	-	-	-	-	-	-	-	1	-	2	3	-	2
CO 3	3	7	8	-	-	-	-	-	-	-	-	-	-	-	1
CO 4	3	8	7	8	1	-	-	-	-	3	-	1	3	1	1
CO 5	3	5	8	7	1	-	-	-	-	1	-	-	3	1	1
CO 6	3	8	6	6	1	-	-	-	-	1	-	-	3	1	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	-	-		50	50	-
CO 2	100	80	-	-	-	-	-	-	-	20	-	16.6	33	20	100
CO 3	100	70	80	-	-	-	-	-	-	-	-	-	100	-	50
CO 4	100	80	70	72.7	100	-	-	-	-	60	-	8.3	-	100	100
CO 5	100	50	80	63.6	100	-	-	-	-	20	-	-	33	33	-
CO 6	100	80	60	54.5	100	-	-	-	-	20	-	-	50	50	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -5 $< C \leq 40\%$ – Low/ Slight

2 - $40\% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	2	2	-
CO 2	3	3	-	-	-	-	-	-	-	1	-	1	1	2	3
CO 3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	2
CO 4	3	3	3	3	3	-	-	-	-	2	-	1	-	3	3

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 5	3	2	3	3	3	-	-	-	-	1	-	-	1	1	-
CO 6	3	3	2	2	3	-	-	-	-	1	-	-	2	2	-
TOTAL	18	14	11	8	9	-	-	-	-	5	-	2	9	10	8
AVERAGE	3	2.8	2.75	2.6	3.0	-	-	-	-	1.25	-	1	2.0	2.0	2.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

-	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**SOFTWARE TESTING, CONCEPTS, ISSUES, AND TECHNIQUES**
	Quality revolution, verification and validation, failure, error, fault, and defect, objectives of testing, testing activities, test case selection white-box and black box, test planning and design, test tools and automation, power of test, test team organization and management, test groups, software quality assurance group, system test team hierarchy, team building.
MODULE II	**SYSTEM TESTING**
	System testing, system integration techniques, incremental, top-down bottom-up sandwich and big bang, software and hardware integration, hardware design verification tests, hardware and software compatibility matrix test plan for system integration. built, in testing. functional testing, testing a function in context. boundary value analysis, decision tables. acceptance testing, selection of acceptance criteria, acceptance test plan, test execution test. software reliability, fault and failure, factors influencing software, reliability models.

MODULE III	**SYSTEM TEST CATEGORIES**
	Taxonomy of system tests, interface tests, functionality tests; GUI tests, security tests feature tests, robustness tests, boundary value tests power cycling tests interoperability tests, scalability tests, stress tests, load and stability tests, reliability tests, regression tests, regulatory tests. Test generation from FSM models, State-Oriented Model, Finite-State Machine Transition Tour Method, testing with state verification, test architectures, local, distributed, coordinated, remote, system test design, 142 — P a g e test design factors requirement identification, modeling a test design process test design preparedness, metrics, test case design effectiveness; System test execution, modeling defects, metrics for monitoring test execution, defect reports, defect causal analysis, beta testing, measuring test effectiveness.
MODULE IV	**SOFTWARE QUALITY**
	Software quality, Peoples Quality Expectations, Frameworks and ISO, 9126, McCalls Quality Factors and Criteria – Relationship, Quality Metrics, Quality Characteristics ISO 9000:2000 Software Quality Standard; Maturity models: Test Process Improvement, Testing Maturity Model
MODULE V	**SOFTWARE QUALITY ASSURANCE**
	Quality Assurance, Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention; Fault tolerance and failure containment, safety assurance and damage control, hazard analysis using fault-trees and event-trees. Comparing quality assurance techniques and activities; QA monitoring and measurement, risk identification for quantifiable quality improvement; Case Study: FSM-Based Testing of Web-Based Applications.

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XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO's to PO's PSO's and their attainments are discussed.	-	-
CONTENT DELIVERY (THEORY)			
2	Quality revolution, verification and validation	CO1	T1: 3.1
3	Failure, error, fault, and defect,	CO1	T1: 3.1
4	Objectives of testing	CO1	T1: 3.3
5	Testing activities	CO1	T1: 3.3
6	Test case selection white-box and black box	CO1	T1: 3.3
7	Test planning and design	CO1	T1: 3.3
8	Test tools and automation	CO1	T1: 3.2
9	Power of test, test team organization and management,	CO1	T1: 3.2
10	Test groups,software quality assurance group	CO1	T1: 3.2
11	System test team hierarchy, team building	CO2	T1: 3.4-3.5
12	System testing, system integration techniques	CO2	T1: 3.4-3.5
13	Incremental, top-down bottom-up sandwich and big bang	CO2	T1: 3.4-3.5
14	Software and hardware integration	CO2	T1: 3.4-3.5
15	Hardware design verification tests	CO1	T1: 1.1-1.7
16	Hardware and software compatibility matrix test plan for system integration	CO1	T1: 1.1-1.7
17	Built in testing, functional testing, testing a function in context	CO2	T1: 2.1-2.5
18	Boundary value analysis	CO2	T1: 2.1-2.5
19	Decision tables	CO2	T1: 2.1-2.5
20	Acceptance testing, selection of acceptance criteria	CO4	T1: 2.3-2.4
21	Acceptance test plan, test execution test	CO4	T1: 2.3-2.4
22	software reliability, fault and failure	CO4	T1: 2.3-2.4
23	Factors influencing software	CO5	T1: 5.3

24	Reliability models	CO5	T1: 5.3
25	Taxonomy of system tests	CO5	T1: 5.3
26	Interface tests, functionality tests	CO3	T1: 5.2
27	GUI tests, security tests feature tests, robustness tests	CO3	T1: 5.2
28	Boundary value tests power cycling tests interoperability tests	CO3	T1: 5.2.2
29	Scalability tests, stress tests, load and stability tests.	CO3	T1: 5.2.2
30	Reliability tests, regression tests, regulatory tests.	CO5	T1: 5.2.4
31	Test generation from FSM models	CO4	T1: 6.1-6.2
32	State-Oriented Model	CO4	T1: 6.1-6.2
33	Finite-State Machine Transition Tour Method,	CO4	T1: 6.1-6.2
34	Testing with state verification	CO4	T1: 6.1-6.2
35	Test architectures	CO4	T1: 6.1-6.2
36	Local, distributed, coordinated, remote, system test design	CO4	T1: 6.4
37	Test design factors requirement identification,	CO4	T1: 6.4
38	Modeling a test design process test design preparedness,	CO4	T1: 6.5
39	Metrics, test case design effectiveness	CO4	T1: 6.5
40	System test execution	CO4, CO6	T1: 6.6
41	Modeling defects, metrics for monitoring test execution	CO4, CO6	T1: 6.6
42	Defect reports, defect causal analysis	CO4, CO6	T1: 6.6
43	Beta testing, measuring test effectiveness.	CO4	T1: 7.1-7.3
44	Software quality, Peoples Quality Expectations, Frameworks and ISO, 9126, McCalls Quality Factors and Criteria – Relationship	CO5	T1: 7.5
45	Quality Metrics, Quality Characteristics ISO 9000:2000 Software Quality Standard	CO5	T1: 7.6
46	Maturity models: Test Process Improvement	CO5	T1: 7.11
47	Testing Maturity Model	CO5	T1: 7.11
48	Quality Assurance, Root Cause Analysis	CO5	T1: 7.11
49	Fault tolerance and failure containment, safety assurance and damage control	CO5,CO6	T1: 7.11
50	Comparing quality assurance techniques and activities; QA monitoring and measurement, risk identification for quantifiable quality improvement;	CO5	T1: 7.11
PROBLEM SOLVING/ CASE STUDIES			
1	Problems on demonstrate the working of the constructs.	CO 1	R2:7.5
2	Problems on System Specifications	CO 2	R2:7.5

3	Problems on Test cases	CO 2	R2:7.5
4	Problems on Test Plans	CO 2	R2:7.5
5	Problems on Test tools	CO 2	R2:7.5
6	Problems on preprocessing techniques and relate to the given data to perform summarization and visualization	CO 3	R2:7.5
7	Problems on applications of selenium	CO 3	R2:7.5
8	Problems on Bugtracking Tool	CO 3	R2:7.5
9	Problems on Bug BIT	CO 3	R2:7.5
10	Problems on Test Managment Tool	CO 3	R2:7.5
11	Problems on Open Source Testing Tool	CO 3	R2:7.5
12	Problems on Automated Functional Testing Tool	CO 4	R2:7.5
13	Problems on Interception of Matrix Multiplication	CO 5	R2:7.5
14	Problems on Functional Testing	CO 6	R2:7.5
15	Problems on QTP(Quick Test Professional) automation testing	CO 6	R2:7.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Define Dichotomy?	CO 1	T1:1.2
2	Define Unit testing?	CO 2	T1:1.6
3	What is transaction flow graph?	CO 3	T1:8,9
4	Name the different types of junctions?	CO 4	T1:9.1
5	What is Equivalence partitioning?	CO 5	T1:10,11
DISCUSSION OF QUESTION BANK			
1	Discuss briefly about Evolutionary process models with neat diagram.	CO 1	T1:1.2
2	Discuss about requirement validation?	CO 2	T1:1.5
3	Write short notes on component level and deployment level design elements	CO 3	T1:8,9
4	Discuss the importance of graph matrices in basis path testing.	CO 4	T1:9.1
5	Determine process metrics and software process improvement	CO 5,6	T1:10,11

Signature of Course Coordinator **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	COMPUTER SCIENCE AND ENGINEERING				
Course Title	NETWORK AND WEB SECURITY				
Course Code	ACIC03				
Program	B.Tech				
Semester	VI				
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Ms. B.K.Aishwarya, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG-20	AITCO6	V	Computer Networks
UG-20	AITC09	V	Web Application Development

II COURSE OVERVIEW:

The course introduces application security in recommending proper mitigations for web security issues, and infrastructure security. The security problems, protocols who have an interest in enhancing the defense of web applications.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Network and Web Security	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
60 %	Understand
20%	Apply
10%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

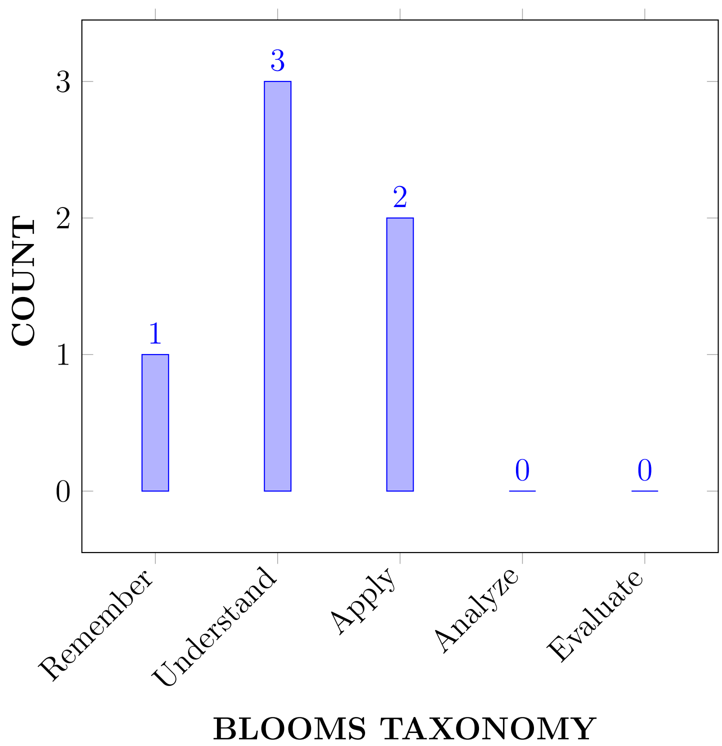
I	The basics of Cryptography and Network Security
II	The process of securing a message over insecure channel by various means
III	The mechanisms for maintaining confidentiality, integrity and availability of a data
IV	The various protocols for network security to protect against the threats in the networks.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Interpret** various protocols(TCP,DNS,SMTP) for solving the security problems in the network	Understand
CO 2	**Solve** unautorized access from the internet by using firewalls, DNSSEC with NSEC3	Apply
CO 3	**Find** computer and network security issues and classify the issues to prevent, detect and recover from the attacks	Remember
CO 4	**Summarize** HTML elements and attributes for structuring and presenting the content of webpage based on the user requirement	Understand
CO 5	**Identify** HTTP pollution and HTTP parameter tammpering attacks by various techniques	Apply
CO 6	**Explain** the mechanisms for maintaining confidentiality,integrity and availability of a data	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Program Outcomes	
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	SEE / CIE / AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	SEE / CIE / AAT
PO 4	**Problem analysis:**Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions (Conduct Investigations of Complex Problems).	1	SEE / CIE / AAT
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction analysis and interpretation of data, and synthesis of the information to provide valid conclusions and modeling to complex engineering activities with an understanding of the limitations.	3	SEE / CIE / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	1	SEE / CIE / AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	2	SEE/AAT
PSO 2	Focus on improving software reliability, network security / information retrieval systems.	2	SEE/AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	✓	✓	-	-	-	-	-	✓	-	-	✓	-	✓
CO 2	✓	-	✓	-	-	-	-	-	-	-	-	-	✓	-	-
CO 3	✓	-	✓	-	-	-	-	-	-	-	-	-	✓	-	-
CO 4	✓	-	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 5	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 6	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	✓	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Describe the relationship between data and signals, their types, behavior, properties, characterization and transmission through the physical layer by understanding mathematical principles and scientific principles.	2
	PO 3	Understand the concepts E-mail, telnet, secure shell for innovative solutions, evaluate the solution of the complex issues.	3
	PO 4	Evaluate the performance of a single link, logical process-to-process (end-to-end) channel, a and a network as a whole (latency, bandwidth, and throughput).	2
	PO 10	Recognize the importance of error detection and correction techniques for optimizing the efficiency of the networks by communicating effectively with engineering community.	2
	PSO1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	6
	PSO3	Practical experience in shipping real world software,using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry	1
CO 2	PO 1	Apply the knowledge of mathematics and Engineering principals to Select firewalls to provide web security as case study in cryptography and network security	2
	PO 3	Outline the customer requirements, maintenance and engineering activities to provide web security using appropriate firewalls.	4
	PSO 1	Understand the problem specific constraints to provide web security by using appropriate firewall	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 3	PO 1	Understand the problem specific constraints to provide web security by using appropriate firewall.	1
	PO 3	Classify the key issues in terms of defining various problems, related to Information Security	2
	PSO 1	Develop various types of viruses and its vulnerabilities.	4
CO 4	PO 1	Knowledge of web and components strongly helps student to design and develop web based engineering solutions	3
	PO 3	Designing and developing static and dynamic web pages can help the student to design and develop practical solutions, to common problems, over the web.	2
	PO 5	Apply appropriate techniques, modern Engineering and IT tools to design a web page with HTML and CSS and use search tools such as browsers to produce the view of webpage .	1
	PO 10	Communicate effectively on complex Engineering activities with the Engineering community related to web development and with society at large, to design web pages and write effective Programming by using the elements of HTML and CSS.	1
	PO 12	Recognize the need for advanced concepts related to HTML and CSS for understanding and developingweb applications through continuing education efforts with ongoing learning – stays up with industry trends.	1
	PSO 1	Identify the Customer needs and problem specific constraints in designing web pages related to the basic concepts of HTML and CSS.	2
	PSO 3	Make use of modern computer tool in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms and desire for higher studies.	1
CO 5	PO 1	Apply the knowledge of mathematics and Engineering principals to Choose appropriate architecture and protocols to provide security to email against attackers and intruders.	2
	PO 2	Make use of appropriate architecture and protocols required for problem identification, formulation, abstraction, data collection, design and to provide security to E-mail and IP	6
	PO 3	Outline the customer requirements, maintenance and engineering activities to provide security to email against attackers and intruders.	2
	PO 10	Security problems on computers will be solved with clear applications of engineering network, security and cryptographic algorithms.	2
	PO 12	Use appropriate techniques and algorithms in computer science related, industry oriented applications for preventing attacks on computers	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 1	Understand the problem specific constraints to prevent attacks on E-mail and IP by choosing appropriate architecture and protocols.	1
	PSO 2	Focus on improving network security by selecting appropriate network security and cryptographic algorithms to prevent attacks on computer.	1
	PSO 3	Extend the use of modern computer tools for creating innovative career paths to prevent attacks on E-mail using appropriate algorithms. .	1
CO 6	PO 1	Apply the knowledge of mathematics and Engineering principals for maintaining confidentiality, integrity and availability of data.	2
	PO 5	Demonstrate modern Engineering and IT tools to design a web page with HTML and CSS and use appropriate techniques to provide security to the data.	1
	PSO 1	Design and analyze computer programs using the concepts of Algorithms to solve the problems of the data security	2
	PSO 2	Design and develop software applications with a focus on high security and reliability of data.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	3	2	-	-	-	-	-	2	-	-	6	-	1
CO 2	2	-	4	-	-	-	-	-	-	-	-	-	4	-	-
CO 3	1	-	2	-	-	-	-	-	-	-	-	-	4	-	-
CO 4	3	-	2	-	1	-	-	-	-	1	-	1	2	-	1
CO 5	2	6	2	-	-	-	-	-	-	2	-	2	1	1	1
CO 6	2	-	-	-	1	-	-	-	-	-	-	-	2	1	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.6	0.0	30.0	18.1	0.0	0.0	0.0	0.0	0.0	40.0	0.0	0.0	100	0.0	50.0
CO 2	66.6	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.6	0.0	0.0
CO 3	33.3	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.6	0.0	0.0
CO 4	100	0.0	20.0	0.0	100	0.0	0.0	0.0	0.0	20.0	0.0	12.5	33.3	0.0	50.0
CO 5	66.6	60.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	25.0	16.6	50.0	50.0
CO 6	66.6	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	50.0	0.0

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -$5 < C \leq 40\%$ – Low/ Slight

2 - $40\% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	1	1	-	-	-	-	-	1	-	-	3	-	2
CO 2	3	-	1	-	-	-	-	-	-	-	-	-	3	-	-
CO 3	1	-	1	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	3	-	1	-	3	-	-	-	-	1	-	1	1	-	2
CO 5	3	3	1	-	-	-	-	-	-	1	-	1	1	2	2
CO 6	3	-	-	-	3	-	-	-	-	-	-	-	1	2	-
TOTAL	16	3	5	1.0	6	-	-	-	-	3	-	2	12	4	6
AVERAGE	2.6	3.0	1.0	1.0	3.0	-	-	-	-	1.0	-	1.0	2.0	2.0	2.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	✓
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**SECURITY PROBLEMS IN NETWORK PROTOCOLS**
	TCP, DNS, SMTP, ROUTING, Problems in TCP/IP protocol suite, survey of BGP security, DNS cache poisoning.
MODULE II	**NETWORK DEFENSE TOOLS**
	Security evaluation of DNSSEC with NSEC3, distributed firewalls, detecting network intruders in real time, network security testing, art of port scanning.
MODULE III	**MALWARE AND ATTACKS**
	Computer viruses, spyware and key, loggers, bot, nets, attacks and defenses, denial of service attacks Control hijacking attacks, exploits and defenses, exploitation techniques and fuzzing

MODULE IV	**BASICS OF WEB SECURITY**
	Web Basics: HTML, CSS, JS, URLs, DOM, Frames, HTTP, Navigation, X-Domain communication, Network Attacks and HTTPS, Limitations of HTTPS, Same Origin Policy and Web Attacker Model, Injection Flaws (I): Cross, site Scripting (XSS), Injection Flaws (II) : XSS (contd.), SQL Injection, OS Command Injection, HTTP Header Injection .
MODULE V	**INSECURE WEB LOGIC**
	Logic Flaws, HTTP Pollution, HTTP Parameter Tampering, Cookie Flaws and Server Misconfiguration, Attacks on User Interfaces, Browser Design and Flaws, User Privacy: Browser and Device Fingerprinting, User Tracking, Browser Caching Flaws

TEXTBOOKS

1. William Stallings, “Network Security Essentials: Applications and Standards”, Pearson Education Limited, 6th Edition, 2016.
2. Uttam K Roy, “Web Technologies”, Oxford University Press, Illustrated Edition, 2010
3. Amanda Berlin and Lee Brotherston, “Defensive Security Handbook”, OReilly, 1st Edition, 2017.
4. John E. Canavan, ” The Fundamentals of Network Security,” Artech House Publishers, In-Print-Forever hardbound Edition, 2001.
5. Chris Bates, “Web Programming: Building Internet Applications”, Wiley, 3rd Edition, 2006.

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1. Jon Duckett, “Beginning Web Programming with HTML, XHTML, and CSS”, WROX, 2nd Edition, 2008.
2. R. W. Sebesta, “Programming World Wide Web”, Pearson, 4th Edition, 2007.
3. Paul Dietel, “Internet and World Wide Web – How To Program”, Pearson, 4th Edition, 2007.
4. Juanita Ellis, Tim Speed, William P. Crowell, ” The Internet Security Guidebook: From Planning to Deployment,” Academic Press, 1st Edition, 2001.
5. Stephen Northcutt, Donald McLachlan, Judy Novak, ” Network Intrusion Detection: An Analyst’s Handbook”, New Riders Publishing, 2nd Edition, 2000.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
	OBE DISCUSSION		
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	https://lms .iare.ac.in/ index ?route =course/details & course id=137
	CONTENT DELIVERY (THEORY)		
1	Transmission Control Protocol	CO 1	T1:1.1
2	Transmission Control Protocol	CO 1	T1:1.1
3	Domain Name System	CO 1	T1:1.1
4	Simple Mail Transfer Protocol	CO 1	T1:1.2
5	ROUTING	CO 1	T1:1.3-1.4
6	Problems on ROUTING	CO 1	T1:1.3-1.4
7	Problems in TCP/IP protocol suite	CO 1	T1:2.3
8	survey of BGP security	CO 1	T1:2.5
9	DNS cache poisoning	CO 1	T1:4.1
10	Security evaluation of DNSSEC with NSEC3	CO 2	T1:5.1
11	Discussion on Security evaluation of DNSSEC with NSEC3	CO 2	T1:5.1
12	Distributed firewalls.	CO 2	T1:6.1
13	Detecting network intruders in real time	CO 2	T1:7.1.1
14	Techniques for Detecting network intruders in real time	CO 2	T1:7.1.1
15	Network security testing	CO 2	T1:8.1.1
16	Art of port scanning.	CO 3	T1:11.4
17	Computer viruses	CO 3	T1:12.5
18	Spyware and key	CO 3	T1:13.1
19	Discussion on loggers	CO 3	T1:13.1
20	Discussion on bot	CO 3	T1:13.1
21	Discussion on nets	CO 3	T1:13.1
22	attacks and defenses	CO 3	T1:14.1
23	denial of service attacks .	CO 3	T2: 5.2
24	Control hijacking attacks	CO 4	T1:16.1
25	Exploits and defenses	CO 3	T1:16.4
26	exploitation techniques and fuzzing	CO 3	T1:20.5
27	Web Basics: HTML, CSS	CO 4	T1:21.4
28	Web Basics: JS, URLs,	CO 4	T1:21.4
29	DOM, Frames, HTTP, Navigation	CO 4	T1:22.1
30	X-Domain communication	CO 4	T1:22.4

31	Network Attacks and HTTPS,	CO 4	T1:22.4
32	Limitations of HTTPS, Same Origin Policy and Web Attacker Model	CO 4	T1:22.4
33	Injection Flaws (I): Cross, site Scripting (XSS)	CO 4	T1:22.4
34	Injection Flaws (II) : XSS (contd.), SQL Injection, OS Command Injection, HTTP Header Injection	CO 4	T1:22.4
35	Logic Flaws, HTTP Pollution	CO 5	T1:22.4
36	Hyper Text Transfer Protocol Pollution	CO 5	T1:22.4
37	HTTP Parameter Tampering, Cookie Flaws and Server Misconfiguration	CO 5	T1:22.4
38	Attacks on User Interfaces, Browser Design and Flaws	CO 5	T1:22.4
39	User Privacy: Browser and Device Fingerprinting	CO 6	T1:22.4
40	User Tracking, Browser Caching Flaws	CO 6	T1:22.4
PROBLEM SOLVING/ CASE STUDIES			
1	Discuss in detail about the connection establishment and release in TCP	CO 1	T2:2.1
2	Discuss about application layer and client server programming	CO 2	T2:2.3
3	Problems on performance issues	CO 2	T2:2.3.1
4	Problems on DNSSEC with NSEC3	CO 6	T2:7.2,7.3
5	Problems on art of port scanning	CO 6	T2:10.3.1
6	Problems on network security testing	CO 4	T2:13.3
7	Problems on distributed firewalls	CO 4	T2:17.1.1, 17.1.3
8	Problems on loggers, bot, nets	CO 4	T2:18.1, 18.2.1
9	Problems on denial of service attack	CO 4	T2:18.3.4, 18.3.4.1
10	Using hooks create state object and update the state of component in reactjs	CO 6	T2:22.12, 19.1.2
11	Design the static web pages required for an online book store web site.	CO 4	T2:18.4, 18.4.3
12	Write down the program to create forms in React?	CO 6	T2:19.2, 18.4.4
13	Develop the calculator using javascript, html and css	CO 5	T2:23.1.1, 23.1.3
14	Develop a web application to control over different layouts.	CO 5	T2:18.3.4, 18.3, 4.1
15	Develop a basic web pages using Reactjs.	CO 4	T2:24.2,28.4
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Security Problems in Network Protocols	CO 1	T2:18.3.4, 18.3.4.1
2	Network Defense Tools	CO 2	T2:22.12, 19.1.2
3	Malware and Attacks	CO3, CO 4	T2:18.4, 18.4.3
4	Basics of Web Security	CO 5	T2:19.2, 18.4.4
5	Insecure Web logic	CO 6	T2:23.1.1, 23.1.3

DISCUSSION ON QUESTION BANK			
1	Security Problems in Network Protocols	CO 1	T2:18.3.4, 18.3.4.1
2	Network Defense Tools	CO 2	T2:22.12, 19.1.2
3	Malware and Attacks	CO3,CO4	T2:18.4, 18.4.3
4	Basics of Web Security	CO 5	T2:19.2, 18.4.4
5	Insecure Web logic	CO 6	T2:23.1.1, 23.1.3

Signature of Course Coordinator **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**SOFT SKILLS AND INTERPERSONAL COMMUNICATION**				
Course Code	AHSC15				
Program	B.TECH				
Semester	VI				
Course Type	OPEN ELECTIVE				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3		3	-	-
Course Coordinator	Ms. S. Veena, Assistant Professor				

I COURSE PREREQUISITES

Level	Course Code	Semester	Prerequisites
IB.Tech	AHSCO1	I,II	Basic principles of soft skills and concepts of functional syntacticalities.

II COURSE OVERVIEW

The objectives of Soft Skills and Interpersonal Communication Skills are to give each student a realistic perspective of work and work expectations. It helps formulate problem solving skills and also it guides students in making appropriate responsible decisions. Besides, it creates a desire to fulfill individual goals, and to educate students about productive thinking, self-defeating emotional impulses, and self- defeating behaviors.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Soft Skills and Interpersonal Communication	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
✓	Open Ended Experiments	✓	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with" either" or" choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question. The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
80%	Understand
20%	Apply
0 %	Analyze
0%	Evaluate
0%	Create

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

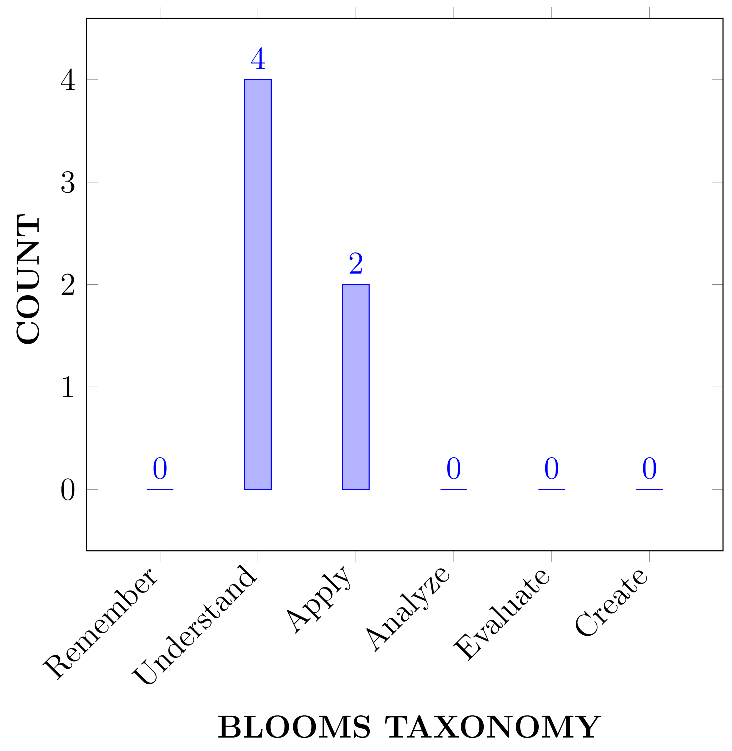
I	Communication skills effectively in both spoken and written languages.
II	All-round personalities with a matured outlook to function effectively in different formal and informal situations. .
III	Self-confidence by mastering inter-personal skills, team management skills, and leadership skills. .
IV	Effective presentation skills which give an edge while interacting with people at all levels.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Apply** soft skills in the development of personality and use them in their daily life.	Apply
CO 2	**Relate** how to listen actively and respond productively to others.	Understand
CO 3	**Classify** the correct usage of English grammar in writing and speaking.	Understand
CO 4	**Demonstrate** the significance of verbal and non-verbal communication in academic and non-academic platforms.	Understand
CO 5	**Explain** some of the strategies and challenges for effective speaking skills and make use of prereading skills to understand the content of advanced level text books.	Understand
CO 6	**Develop** various written communication strategies of cover letter writing, resume writing, E-mail writing and report writing.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO8	**Communication:**Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice (Ethics). 1. **Comprises four components: ability to make informed ethical choices, knowledge of professional codes of ethics, evaluates the ethical dimensions of professional practice, and demonstrates ethical behavior.** 2. **Stood up for what they believed in** 3. **High degree of trust and integrity**	3	Seminar/ Conferences/ Quiz/ AAT Assignments/ Discussion

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO9	**Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings (Individual and Teamwork). 1. **Independence** 2. **Maturity – requiring only the achievement of goals to drive their performance** 3. **Self-direction (take a vaguely defined problem and systematically work to resolution)** 4. **Teams are used during the classroom periods, in the hands-on labs, and in the design projects.** 5. **Some teams change for eight-week industry oriented Mini-Project, and for the seventeen - week design project.** 6. **Instruction on effective teamwork and project management is provided along with an appropriate textbook for reference.** 7. **Teamwork is important not only for helping the students know their classmates but also in completing assignments.** 8. **Students also are responsible for evaluating each other's performance, which is then reflected in the final grade.** 9. **Subjective evidence from senior students shows that the friendships and teamwork extends into the Junior years, and for some of those students, the friendships continue into the workplace after graduation.** 10. **Ability to work with all levels of people in an organization** 11. **Ability to get along with others** 12. **Demonstrated ability to work well with a team**	12	Seminar / Conferences /Quiz / AAT / Assignments / Discussion

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. 1. **Clarity (Writing) Style (Oral)** 2. **Grammar/Punctuation (Writing)** 3. **References (Writing)** 4. **Speaking** 5. **Subject Matter (Oral)**	5	Seminar/ Conferences/ Quiz/ AAT Assignments/ Discussion

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	-	-
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	✓	✓	✓	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	✓	-	✓	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-

-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 8	Demonstrate the basic **professional ethics** of ethical choices, codes of ethics, professional practice, and ethical behaviour with special respect to the usage of soft skills and personality development. Besides, students are designed to **stand up for what they believed in** and they are encouraged to maintain a **high degree of trust and integrity.**	3
CO 2	PO 10	Explain with **clarity** on listening an audio clip and also maintain appropriate oral presentation skills with proper **grammatical** skills in both writing and **speaking** situations.	5
CO 3	PO 10	Describe the usage of **grammatical** knowledge in **writing** and **speaking** areas and also discuss the apt applicability of different grammar rules in **oral** presentations with **clarity.**	5
CO 4	PO8, PO 9, PO10	Illustrate **ethical choices knowledge of professional codes of ethics** and also **evaluates the ethical dimensions of professional practice** and demonstrates **ethical behaviour**. Besides, **stood up for what they believe in** and moreover **discover high degree of trust and integrity. Apply the knowledge with independence and maturity to achieve desired goals and also maintain self-direction method to lead the team members while designing the projects. Moreover, it is observed to build an effective teamwork with an appropriate textbook for reference. Besides, explain the significance of teamwork to complete assignments. And also, interpret the complex concepts with subjective evidence to develop ability to work with all levels of people. Therefore, summarize demonstrated ability to work well with a team.** At the same time, extend the knowledge on **subject matter** with appropriate **clarity** using with proper **grammatical** structures in both areas of **speaking** and **written** communication practices.	20

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 5	PO8 PO 10	Interpret **ethical choices and knowledge of professional codes of ethics and also evaluates ethical dimensions of professional practice and demonstrates ethical behaviour** at workplace. Besides, illustrates how to **stand up for what they believed in.** Furthermore, **practice high degree of trust and integrity.** Choose appropriate **reading** strategies in order to understand with proper **clarity.** Moreover, predict **syntactical** structures used in **spoken** communication and **written communication.**	8
CO 6	PO 10	Classify different **oral** and **written** communication strategies through systematic order and also recognize appropriate method in order to understand the writer's point of view with **clarity** while **reading** and practices proper **grammatical** functionalities to understand different **subject matters.**	5

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	3	12	5	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	3	-	5	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	100	0.0
CO 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0
CO 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0
CO 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	100	100	0.0	0.0	00	100	0.0
CO 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	100	0.0	0.0	0.0	0.0	0.0
CO 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 ≤ C≤ 5% – No correlation

1 -5 <C≤ 40% – Low/ Slight

2 - 40 % <C < 60% –Moderate

3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
CO 2	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
CO 3	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
CO 4	0	0	0	0	0	0	0	3	3	3	0	0	0	0	0
CO 5	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0
CO 6	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
TOTAL								9		15			0	0	0
AVERAGE								3		3				0	0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	✓	10 Minutes Video	✓	Open Ended Experiments	✓
Assignments	✓				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

-	Assessment of mini projects by experts	✓	End Semester OBE Feedback
✓	Early Semester Feedback		

XVIII SYLLABUS:

MODULE I	**SOFT SKILLS**
	Soft Skills: An Introduction – Definition and significance of soft skills; Process, Importance and application of soft skills, discovering the self; setting goals; positivity and motivation: developing positive thinking and attitude
MODULE II	**EFFECTIVENESS OF SOFT SKILLS**
	Developing interpersonal relationships through effective soft skills; Define Listening, Speaking, Reading and Writng skills; Barriers to Listening, Speaking, Reading and Writing; Essential formal writing skills; Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking.

MODULE III	**ORAL AND AURAL SKILLS**
	Sounds of English vowels sounds and consonant sounds, Word Accent and connected speech- contractions, questions tags, Listening for information, Taking notes while listening to lectures (use of Dictionary). Group Discussion: Importance, Planning, Elements, Skills, Effectively disagreeing, Initiating
MODULE IV	**VERBAL AND NON-VERBAL COMMUNICATION**
	Interpersonal communication-verbal and nonverbal etiquette; Body language, grapevine, Postures, Gestures, Facial expressions, Proximity; Conversation skills, Critical thinking, Teamwork, Group Discussion, Impact of Stress; Measurement and Management of Stress
MODULE V	**WRITTEN COMMUNICATION**
	Significance; Effectiveness of writing; Organizing principles of Paragraphs in documents; Writing introduction and conclusion; Techniques for writing precisely; Letter writing; Formal and Informal letter writing; E-mail writing, Report Writing.

TEXTBOOKS

1. Raman Meenakshi, Upadhyay Shalini (2017). Soft Skills: Key to Success in Workplace and Life. Cengage India Private Limited, Noida.
2. Handbook of English for Communication (Prepared by Faculty of English, IARE)

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1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2. Klaus, Peggy, Jane Rohman & Molly Hamaker. —The Hard Truth about Soft Skill, London: HarperCollins E-books, 2007.
3. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
4. Stein, Steven J. & Howard E. Book. —The EQ Edge: Emotional Intelligence and Your Success Canada: Wiley & Sons, 2006
5. Suresh Kumar. English for Success. Cambridge University Press IndiaPvt.Ltd.2010.
6. Dorling Kindersley. Communication Skills & Soft Skills - An Integrated Approach. India Pvt. Ltd. 2013.

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2. www.edufind.com
3. www.myenglishpages.com
4. http://grammar.ccc.comment.edu
5. http://owl.english.prudue.edu

E-TEXT BOOKS:

1. http://bookboon.com/en/communication-ebooks-zip
2. http://www.bloomsbury-international.com/images/ezone/ebook/writing-skills-pdf.pdf

3. http://learningenglishvocabularygrammar.com/files/idiomsandphraseswith meaningsandexamplespdf.pdf

4. http://www.robinwood.com/Democracy/General Essays/CriticalThinking.pdf

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Discussion on mapping COs with POs (OBE)		T1:06.06
CONTENT DELIVERY (THEORY)			
2	Introduction of soft skills	CO 1	T1:06.09
3	Significance of soft skills..	CO 1	T1:09.10
4	Process, importance and application of soft skills..	CO 1	T1:08:05
5	Discovering one's self-qualities.	CO 1	T1:06:02
6	Setting up goals	CO 1	T1:04:74
7	Positivity and motivation.	CO 1	T1:01:08
8	Developing one's positive thinking and attitude	CO 1	T1:03:01
9	Developing interpersonal relationships through soft skills..	CO 2	T1:06:05
10	Significance of listening skills.	CO 2	T1:02:09
11	Significance of speaking skills.	CO 4	T1:26:11
12	Significance of reading skills..	CO 5	T1:46:08
13	Significance of writing skills.	CO 6	T1:16:20
14	Barriers to listening and speaking.	CO 2	T1:13:43
15	Barriers to reading and writing.	CO 5	T1:40:51
16	Essentials of formal writing skills.	CO 6	T1:19:07
17	Developing public speaking skills.	CO 4	T1:69:62
18	Methods, strategies of public speaking..	CO 4	T1:5:05
19	Essential tips for effective public speaking.	CO 4	T1:46:05
20	Introduction to sounds of vowels and consonants.	CO 4	T1:09:18
21	Contractions and questions tags.	CO 3	T1:07:14
22	Listening for information.	CO 1	T1:32:96
23	Taking notes while listening to lectures.	CO 3	T1:55:21
24	Group discussion and its importance.	CO 2	T1:14:25
25	Planning, elements, skills, effectively, disagreeing, initiating.	CO 2	T1:08:08
26	Developing interpersonal communication skills.	CO 4	T1:22:74
27	The role of verbal and nonverbal etiquettes in one's career.	CO 1	T1:32:36
28	Significance of body language,	CO 1	T1:78:12
29	Grapevine communication.	CO 4	T1:01:08
30	Developing critical thinking.	CO4	T1:04:18
31	Conversation skills at formal and informal situations. .	CO 4	T1:06:08
32	The power of group discussion and the role of a team work.	CO 4	T1:03:22
33	Impact of stress; measurement and management of stress.	CO 4	T1:89:01

34	Significance and effectiveness of writing.	CO 6	T1:01:04
35	Organizing principles of paragraphs in documents;	CO 4	T1:74:32
36	Writing introduction and conclusion	CO 1	T1:25:10
37	Techniques for writing precisely;	CO 6	T1:09:07
38	Letter writing; Formal and Informal letter writing;	CO 6	T1:60:31
39	Rules of E-mail writing.	CO 6	T1:22:12
40	Strategies of report writing.	CO 6	T1:01:01
	PROBLEM SOLVING/ CASE STUDIES		
1	Soft skills can help someone come out of difficult situations and ensure reassurance along with reliability. think critically and answer	CO 1	R2:7.5
2	Will not hard skills suffice the requirement needed in a corporate setup without soft skills?	CO 1	R2:7.5
3	Do you think soft skills are communication skills? If so, give your reasons	CO 1	R2:7.5
4	Describe the way interpersonal communication can influence the psychological health of individuals with examples.	CO 1	R2:7.5
5	What do you mean by 'assumption' in the communication process and explain with a real -life example?	CO 1	R2:7.5
6	Explain with examples the self-fulfillment and happiness of productive interpersonal communication skills.	CO 1	R2:7.5
7	Explain the importance of learning the sounds of English language for fluent and confident communication.	CO 3	R2:7.5
8	Mispronunciation of English words may lead to miscommunication and misconception. Elaborate with the help of an example.	CO 3	R2:7.5
9	Throw light on word stress which is pivotal for proper differentiation of sounds.	CO 3	R2:7.5
10	Differentiate between verbal and non-verbal communication	CO 4	R2:7.5
11	Classify non-verbal skills and explain the various skills that are important	CO 4	R2:7.5
12	Write down advantages of non-verbal skills	CO 4	R2:7.5
13	What is the meaning of thesis focus? Explain in detail.	CO 6	R2:7.5
14	What do you understand by organization?	CO 6	R2:7.5
15	Support and Elaboration is an extension and development of the topic/subject/ thesis. Comment.	CO 6	R2:7.5
	DISCUSSION OF DEFINITION AND TERMINOLOGY		
41	Definition and terminology of soft skills	CO 1	T1:69:08
42	Definition and terminology of contractions	CO 3	T1:65:66
43	Definition and terminology of question tags	CO 3	T1:42:03
44	Definition and terminology of verbal and nonverbal communication	CO 4	T1:78:78
45	Definition and terminology of self discovery	CO 1	T1:09:01
	DISCUSSION OF QUESTION BANK		
1	Module I - Soft skills and interpersonal communication	CO 1,2	R4:2.1
2	Module II - Effectiveness of soft skills	CO 2,3	T4:7.3

3	Module III - Oral and aural skills	CO 4	R4:5.1
4	Module IV - Verbal and nonverbal communication	CO 5	T1:7.5
5	Module V - Interpersonal communication	CO 6	T1: 4.1

Signature of Course Coordinator **HOD**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**SOFTWARE PROJECT MANAGEMENT**				
Course Code	ACIC05				
Program	B.Tech				
Semester	VI				
Course Type	Elective				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	-	-	3
Course Coordinator	Ms. D.Rajani, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG-20	ACSC19	V	Object Oriented Software Engineering

II COURSE OVERVIEW:

The main goal of software development projects is to create a software system with a predetermined functionality and quality in a given time frame and with given costs. For achieving this goal models are required for determining target values and for continuously controlling these values. This course focuses on principles, techniques, methods and tools for model-based management of software projects. Assurance of product quality and process adherence (quality assurance), as well as experience-based creation and improvement of models (process management).

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Software Project Management	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
60 %	Understand
20%	Apply
10%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

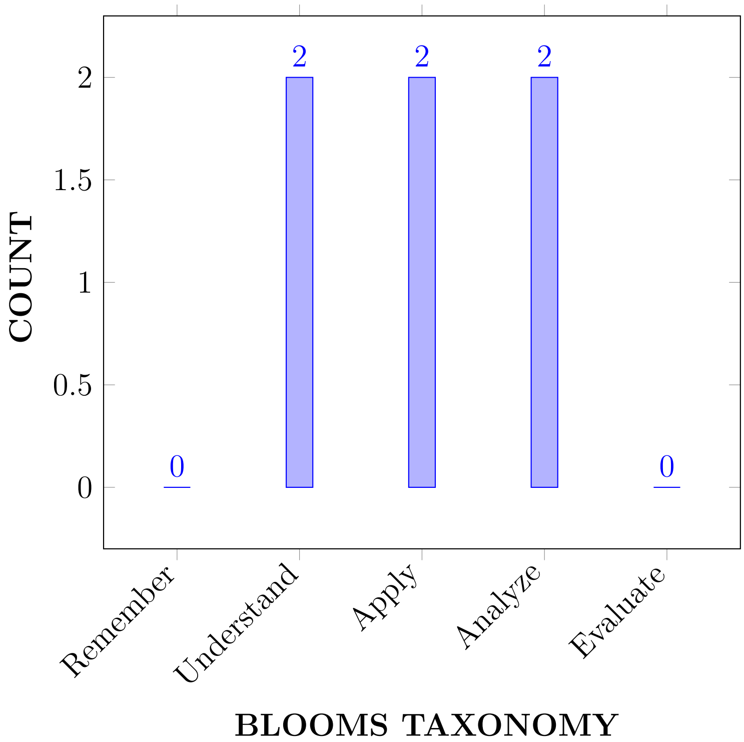
I	The specific roles within a software organization as related to project and process management
II	The basic infrastructure competences (e.g., process modeling and measurement).
III	The basic steps of project planning, project management. Quality assurance, and process management and their relationships.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Outline** process models,apporaches and techniques for managing software development process.	Understand
CO 2	**Evaluate** professional ethics in successful project development	Apply
CO 3	**Elaborate** the life cycle of project management .	Analyze
CO 4	**Analyze** evaluation of organization and core metrics for project organization.	Understand
CO 5	**Apply** model based architectural concepts for building software	Apply
CO 6	**Determine** case study on future software project management practices in business context and scope of the project..	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations

Program Outcomes	
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	SEE / CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	SEE / CIE / AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction analysis and interpretation of data, and synthesis of the information to provide valid conclusions and modeling to complex engineering activities with an understanding of the limitations.	3	SEE / CIE / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	2	SEE / CIE / AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	1	SEE/AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	-	-
CO 2	-	✓	-	-	-	-	-	-	-	✓	-	✓	-	-	✓
CO 3	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	✓
CO 4	✓	-	✓	-	-	-	-	-	-	✓	-	✓	-	✓	✓
CO 5	✓	-	✓	-	✓	-	-	-	-	-	-	-	-	-	✓
CO 6	-	-	-	-	✓	-	-	-	-	✓	-	✓	-	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Usage of basic engineering tools will help to understand the problem definition and provide knowledge on IT tools.	1
	PO 5	Use of Modern tools can availthe facility to upgrade software models and designs to improve efficiency of the tools and techniques.	1
	PSO1	Apply diffrent process models leads to have better solution models and upgraded designs to slove computing problems.	1
CO 2	PO 2	By identifying and analysing engineering problem can avail better project planning activities to schedule the project planning.	3
	PO 10	Software models can effectively communicate engineering problems and solutions and used to make effective reports in the project planning.	4
	PO 12	Using lifelonglearning new methodlogies will impart effective models and designs in project planning activities and schedules.	1
	PSO 3	Use of new technologies and innovation will improve the project planning and selection of protfolios.	2
CO 3	PO 1	Applying engineering knowledge will improve the performance of software models and can analyze the advantages by comparing with current and basuc models in software development.	1
	PO 3	Usage of models is to design solutions to complex software problems and helps to design system commponents acrroding to customer requirements.	7
	PSO 3	Following new trends will help to create effective software models in the context of technological change.	1
CO 4	PO 1	Using engineering basic prinicples of software design models will be able to build software architechture of the system.	1
	PO 3	Design solutions for simple and complex problems by Defining problem, understand customer requirements, identifying basic building blocks to draw UML diagrams.	6
	PO 10	Communicate with structural and behavioral design patterns effectively on complex engineering activities with the engineering community and give and receive clear instructions.	4
	PSO 3	Make use of computational and advanced CASE tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	1
CO 5	PO 1	Apply Architectural and domain model Engineering knowledge and modelling principles, in identifying basic building blocks for visualizing artifacts of system.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	Design representation of Next gen POS system for simple and complex problems by Defining problem, understand customer requirements, identifying basic building blocks to draw UML diagrams.	6
	PO 5	Communicate static and dynamic aspects of the system using using system sequence and use case diagrams. For specifying structure and interaction of objects during runtime	2
	PSO 3	Formulate and Evaluate engineering concepts to Design next-generation computer systems by using advanced building blocks of UML.	1
CO 6	PO 5	Usage of modern tools of testing and software quality will improvethe standards of verification and validation of the system.	1
	PO 10	Verification and validation willcommunicate the effectiveness of the system in real - world environment before deploying the project.	4
	PO 12	In the changing technological context life- long learning will enable to adopt changes in new verification and validation methods.	1
	PSO 3	Usage of innovative verification and validation tools will improve the quality of designs amd models in creating components of system architechture.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	1	-	-	-	-	-	-	-	2	-	-
CO 2	-	3	-	-	-	-	-	-	-	4	-	1	-	-	2
CO 3	1	-	7	-	-	-	-	-	-	-	-	-	-	-	1
CO 4	1	-	6	-	-		-	-	-	4	-	-	-	-	1
CO 5	1	-	6	-	1	-	-	-	-	-	-	-	-	-	2
CO 6	-	-	-	-	1	-	-	-	-	4	-	1	-	-	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	33.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0
CO 2	0.0	33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	12.5	0.0	0.0	50.0
CO 3	33.0	0.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
CO 4	33.0	0.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	25.0
CO 5	33.0	0.0	60.0	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.	0.0	50.0	50.0
CO 6	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	80.0	0.0	12.5	0.0	50.0	25.0

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 - $5 < C \leq 40\%$ – Low/ Slight
2 - $40\ \% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	3	-	-	-	-	-	-	1	1	-	-
CO 2	-	1	-	-	-	-	-	-	-	3	-	1	-	-	2
CO 3	1	-	3	-	-	-	-	-	-	-	-	-	-	-	1
CO 4	1	-	3	-	-	-	-	-	-	3	-	-	-	-	1
CO 5	1	-	3	-	3	-	-	-	-	-	-	-	-	-	2
CO 6	-	-	-	-	3	-	-	-	-	3	-	1	-	-	1
TOTAL	4	1	12	-	9	-	-	-	-	9	-	3	1	-	7
AVERAGE	1.0	1.0	3.0	-	3.0	-	-	-	-	3.0	-	1.0	1.0	-	2.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	✓
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**CONVENTIONAL SOFTWARE MANAGEMENT**
	The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics. Pragmatic software cost estimation.
MODULE II	**IMPROVING SOFTWARE ECONOMICS**
	Reducing Software product size, improving software processes, improving team effectiveness. Improving automation, Achieving required quality, peer inspections. The old way and the new- The principles of conventional software engineering. Principles of modem software management, transitioning to an iterative process.
MODULE III	**LIFE CYCLE PHASES**
	Engineering and production stages, inception. Elaboration, construction, transition phases. Artifacts of the process: The artifact sets. Management artifacts, Engineering artifacts, programmatic artifacts. Model based software architectures: A Management perspective and technical perspective.
MODULE IV	**PROJECT ORGANIZATIONS**
	Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation the seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.
MODULE V	**CASE STUDIES**
	CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles, NextGeneration software Economics, Modern Process Transitions

TEXTBOOKS

1. Walker Royce, "Software Project Management", Pearson Education, 6th Edition, 2000.
2. Bob Hughes and Mike Cotterell, "Software Project Management", Tate McGraw H, 4th Edition, 2000

REFERENCE BOOKS:

1. Andrew SteIbian 8 Jennifer Greene, "Applied Software Project Management", OReilly. 2006.
2. Jennifer Greene and Andrew Steliman, "Head First PMP", O RoiHy, 2007.
3. Richard H. Thayer and Edward Yourdon, "Software Engineering Project Management", Wiley India, 2nd Edition, 2004.
4. Jim Highsniith, "Ale Project Management", Pearson Education, 2004.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	https://lms .iare.ac.in/ index ?route =course/details & course id=137
CONTENT DELIVERY (THEORY)			
1	The waterfall model	CO 1	T1:1.1
2	The waterfall model	CO 1	T1:1.1
3	The waterfall model	CO 1	T1:1.1
4	conventional software Management performance.	CO 1	T1:1.2
5	conventional software Management performance.	CO 1	T1:1.2
6	Evolution of Software Economics:Software Economics	CO 1	T1:1.3-1.4
7	Evolution of Software Economics:Software Economics	CO 1	T1:1.3-1.4
8	Pragmatic software cost estimation.	CO 1	T1:2.3
9	Pragmatic software cost estimation.	CO 1	T1:2.3
10	Reducing Software product size,	CO 1	T1:2.5
11	improving software processes	CO 2	T1:4.1
12	improving team effectiveness	CO 2	T1:5.1
13	Improving automation.	CO 2	T1:6.1
14	Achieving required quality	CO 2	T1:7.1.1
15	peer inspections	CO 2	T1:8.1.1
16	The old way and the new- The principles of conventional software engineering	CO 2	T1:11.4
17	Principles of modem software management	CO 3	T1:12.5
18	transitioning to an iterative process.	CO 3	T1:13.1
19	Engineering and production stages, inception. Elaboration, construction, transition phases	CO 3	T1:13.1
20	Engineering and production stages, inception. Elaboration, construction, transition phases	CO 3	T1:13.1
21	Artifacts of the process: The artifact sets. Management artifacts, Engineering artifacts, programmatic artifacts.	CO 3	T1:14.1

22	Artifacts of the process: The artifact sets. Management artifacts, Engineering artifacts, programmatic artifacts.	CO 3	T1:14.1
23	Artifacts of the process: The artifact sets. Management artifacts, Engineering artifacts, programmatic artifacts.	CO 3	T1:14.1
24	Artifacts of the process: The artifact sets. Management artifacts, Engineering artifacts, programmatic artifacts.	CO 3	T1:14.1
25	Artifacts of the process: The artifact sets. Management artifacts, Engineering artifacts, programmatic artifacts.	CO 3	T1:14.1
26	Model based software architectures: A Management perspective and technical perspective. .	CO 4	T2: 5.2
27	Model based software architectures: A Management perspective and technical perspective. .	CO 4	T2: 5.2
28	Project Organizations Line-of- business organizations, project organizations, evolution of organizations	CO 4	T1:16.1
29	Project Organizations Line-of- business organizations, project organizations, evolution of organizations	CO 4	T1:16.1
30	process automation	CO 5	T1:16.4
31	process automation	CO 5	T1:16.4
32	Project Control and process instrumentation the seven-core metrics, management indicators, quality indicators modularity.	CO 5	T1:20.5
33	Project Control and process instrumentation the seven-core metrics, management indicators, quality indicators modularity.	CO 5	T1:20.5
34	Project Control and process instrumentation the seven-core metrics, management indicators, quality indicators modularity.	CO 5	T1:20.5
35	Project Control and process instrumentation the seven-core metrics, management indicators, quality indicators modularity.	CO 5	T1:20.5
36	life-cycle expectations,Pragmatic software metrics, metrics automation..	CO 5	T1:21.4
37	CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles	CO 6	T1:22.1

38	CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles	CO 6	T1:22.1
39	CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles	CO 6	T1:22.1
40	CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles	CO 6	T1:22.1
41	CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles	CO 6	T1:22.1
42	NextGeneration software Economics, Modern Process Transitions	CO 6	T1:22.4
43	NextGeneration software Economics, Modern Process Transitions	CO 6	T1:22.4
44	NextGeneration software Economics, Modern Process Transitions	CO 6	T1:22.4
45	NextGeneration software Economics, Modern Process Transitions	CO 6	T1:22.4
PROBLEM SOLVING/ CASE STUDIES			
1	Identify the main types of personnel employed in an information systems department .For each stage of a typical IS development projects, list the types of personnel who ar likely to be involved	CO 1	T2:2.1
2	Classify and describe four fundamental process activities which are common to all software processes.	CO 2	T2:2.3
3	List four facts which indicate that the requirement capture and analysis process to be very difficult.	CO 2	T2:2.3.1
4	List the problems experienced when you carried out a recent ICT - related assignment.Try tomput these problems into some order of magnitude.For each problem considere whether their was some way in which the problem could have been reduced by better organisation and planning by yourself.	CO 6	T2:7.2,7.3
5	Assume that you wise to buy a car. Identify all the attributes and methods of the car object. Write a short description of services that each will provide. Create a class hierarchy of the “car” class.	CO 6	T2:10.3.1
6	Identify the major risks that could effect the success of brightmouth college pay role project and try to rank them in order of importance	CO 4	T2:13.3

7	Evaluate if you were asked as an expert to provide an estimate of the effort need to make certain changes to an exisisting piece of software , what information would you like to have to hand to assist you in making the estimate.	CO 4	T2:17.1.1, 17.1.3
8	List out on basis of large project it is often be the responsibility of a team leader to allocate tasks to individuals.Why might it be unsatisfactory to leave such allocations entirely to discretion of the team leader.	CO 4	T2:18.1, 18.2.1
9	Describe a set of change control procedures that would be appropriate for Brigette to implement at brightmouth college.	CO 4	T2:18.3.4, 18.3.4.1
10	Assume that if you have been involved recently in a group activity or project, try to categorize each participant according to Belbin classification.Were their any duplications or gaps in any of the roles?DId this seem to have any impact on progress.	CO 6	T2:22.12, 19.1.2
11	Evaluate how you measure the effectiveness of a user manual for software package? Considere both the measurements that might to applicable and the procedures by which the measurements might be taken.	CO 4	T2:18.4, 18.4.3
12	Elaborate the key responsibilities of project manager in developing the Next Gen POS system with suitable examples.	CO 6	T2:19.2, 18.4.4
13	Desribe how manager distributes tasks for each individual for ATM system development.	CO 1	T2:23.1.1, 23.1.3
14	Consider the Hospital Management System application with the following requirements i. System should handle the in- patient, out-patient information through receptionist. ii. Doctors are allowed to view the patient history and give their prescription iii. There should be a information system to provide the required information Elaborate how would you distribute work amoung team members.	CO 5	T2:18.3.4, 18.3, 4.1
15	Assume that you are a team member of the certain project and have conflict with other team member. How would you handle it.	CO 4	T2:24.2,28.4
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Conventional Software Management	CO 1	T2:18.3.4, 18.3.4.1
2	Improving Software Economics	CO 2	T2:22.12, 19.1.2
3	Life Cycle Phases	CO3, CO 4	T2:18.4, 18.4.3
4	Project Organisaion	CO 5	T2:19.2, 18.4.4
5	Case Studies	CO 6	T2:23.1.1, 23.1.3

DISCUSSION ON QUESTION BANK			
1	Conventional Software Management	CO 1	T2:18.3.4, 18.3.4.1
2	Improving Software Economics	CO 2	T2:22.12, 19.1.2
3	Life Cycle Phases	CO3,CO4	T2:18.4, 18.4.3
4	Project Organisaion	CO 5	T2:19.2, 18.4.4
5	Case Studies	CO 6	T2:23.1.1, 23.1.3

Signature of Course Coordinator **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Department	COMPUTER SCIENCE AND ENGINEERING				
Course Title	DISASTER MANAGEMENT				
Course Code	ACEC31				
Program	B.Tech				
Semester	VI				
Course Type	Open Elective				
Regulation	IARE-UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr. P. Sreekanth Reddy, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	-	-	-

II COURSE OVERVIEW:

The Disaster management provides a fundamental understanding of different aspects. It deals with the concepts and functions of disaster management to build competencies of professionals and development practitioners. It provides effective supporting environment by the governmental locating substantial resources for effective mitigation of disasters. It helps learners to apply the disaster mitigation strategies, preparedness for reducing damage intensity, loss of life and property.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Disaster Management	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Percentage of Cognitive Level	Blooms Taxonomy Level
17%	Remember
83 %	Understand
0%	Apply
0 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered. **Alternative Assessment Tool (AAT)**

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	**Tech-talk**	**Complex Problem Solving**
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

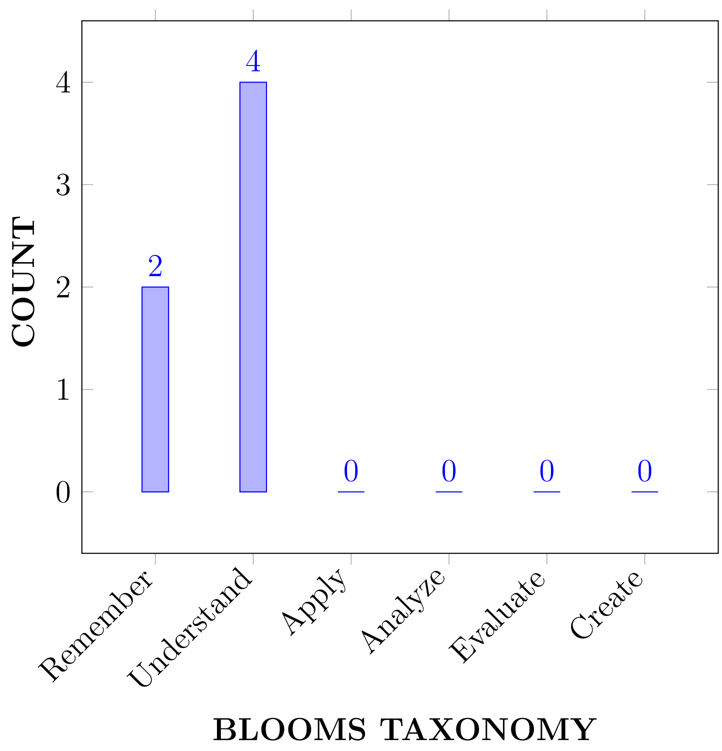
I	The concept of environmental hazards, disasters and various approaches dealing with the mitigation of disasters.
II	The knowledge on various types of environmental disasters and their impacts on human beings and nature.
III	The Different types of endogenous and exogenous hazards and their influence on human life and nature.
IV	The immediate response and damage assessment with information reporting and monitoring tools.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Classify** Environmental hazards for developing modern disaster management system.	Remember
CO 2	**Illustrate** various approches for reducing the level of risk associated with Disasters.	Understand
CO 3	**Compare** natural and manmade disasters for finding out intensity of damage loss occurred by them.	Understand
CO 4	**List** various hazards and their effects for evaluating their impact on society and Environment.	Remember
CO 5	**Outline** human adjustments and perception towards hazards for mitigation of disasters.	Understand
CO 6	**Summarize** disaster phenomenon and its different contextual aspects for implementing the Disaster Risk Reduction Strategy.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/SEE/AAT
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	3	CIE/SEE/AAT
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	3	CIE/SEE/AAT
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	1	CIE/SEE/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	-	-
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	✓	-	-	-	-	-	✓	-	-	-	-	-	-	-	-
CO 2	✓	-	-	-	-	✓	-	-	-	-	-	-	-	-	-

CO 3	-	-	-	-	-	✓	✓	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	-	✓	✓	-	-	-	-	-	-	-	-
CO 5	✓	-	-	-	-	✓	-	-	-	-	-	-	-	-	-
CO 6	✓	-	-	-	-	✓	-	-	✓	-	-	-	-	-	-

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Apply the knowledge and principals of mathematics to engineering problems in determining an area enclosed by irregular boundary line using the knowledge of **mathematics and science fundamentals**	2
	PO 7	Understand the disaster management by considering Environmental impacts on the livelihood and their effect on Socio economic issues for sustainable development.	2
CO 2	PO 1	Apply the knowledge on various disaster mitigation approaches in **engineering disciplines** and and use their application in geographical researches.	1
	PO 6	Apply the engineering knowledge in disaster management to **promote sustainable development** and build **Awareness on health, safety,** and **risk issues** associated with Disasters.	4
CO 3	PO 6	Identify **engineering activities including personnel, health, safety, and risk and effective disaster management strategies** for implementing, analyzing disaster impacts on human life and environment.	4
	PO 7	Understand intensity of disasters and their impact on **environment** and influence on **socio economic** parameter for assessment of intensity of risk.	2
CO 4	PO 6	Identify **engineering activities including personnel, health, safety, and risk** for analyzing hazard impacts on environment.	4
	PO 7	Identify the impact of various hazards in **socio economic and environmental** aspects for developing modern disaster management system.	2
CO 5	PO 1	Understand the **methodology and scientific principal towards** hazards for human adjustments and perception by sharing technological knowledge from **other engineering branches.**	2
	PO 6	Understanding of the need for a **high level of professional and ethical conduct in engineering** for human adjustments, perception with effective **management strategies**for disaster mitigation.	4

CO 6	PO 1	Understand the **knowledge of scientific principal and methodology** in disaster phenomenon for minimizing impact by implementing the Disaster Risk Reduction Strategy.	2
	PO 6	**Appropriate management strategies** are to be applied to reduce the level of risk in disaster mitigation.	1
	PO 9	Apply disaster risk reduction strategy using vrious organizations and **work effetively as an individual** and **as a member** or **a leader** are to be applied to reduce the level of risk in disaster mitigation.	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	Program Outcomes/ No. of Key Competencies Matched												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	1	2	3
CO 1	2	-	-	-	-	-	2	-	-	-	-		-	-	-
CO 2	1	-	-	-	-	4	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	4	2	-	-	-	-		-	-	-
CO 4	-	-	-	-	-	4	2	-	-	-	-	-	-		-
CO 5	2	-	-	-	-	4	-	-	-	-	-	-	-	-	-
CO 6	2	-	-	-	-	1	-	-	3	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	1	2	3
CO 1	66.6	-	-	-	-	-	66.6	-	-	-	-	-	-	-	-
CO 2	33.3	-	-	-	-	80	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	80	66.6	-	-	-	-	-	-		-
CO 4	-	-	-	-	-	80	66.6	-	-	-	-	-	-	-	-
CO 5	66.6	-	-	-	-	80	-	-	-	-	-	-	-	-	-
CO 6	66.6	-	-	-	-	20	-	-	25	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.
0 - $0 \leq$ C$\leq$ 5% – No correlation
1 - $5 \leq$ C$\leq$ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% $\leq$ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	1	2	3
CO 1	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO 2	1	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	3	3	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	-	3	3	-	-	-	-	-	-		-
CO 5	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO 6	3	-	-	-	-	1	-	-	1	-	-	-	-	-	-
TOTAL	10	-	-	-	-	13	9	-	1	-	-	-	-	-	-
AVERAGE	3	-	-	-	-	3	3	-	1	-	-	-	-	-	-

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Term Paper	-	Concept Video	✓	Open Ended Experiments	-
Assignments	-	Mini project	-	Tech Talk	✓

XVII ASSESSMENT METHODOLOGY INDIRECT:

x	Assessment of mini projects by Experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**ENVIRONMENTAL HAZARDS AND DISASTERS**
	Environmental hazards and disasters: meaning of environmental hazards, environmental disasters and environmental stress; concept of environmental hazards, environmental stress and environmental disasters, different approaches and relation with human ecology, landscape approach, ecosystem approach, perception approach, human ecology and its application in geographical researches.
MODULE II	**TYPES OF ENVIRONMENTAL HAZARDS AND DISASTERS**
	Types of environmental hazards and disasters: Natural hazards and disasters, man induced hazards and disasters, natural hazards, planetary hazards/ disasters, extra planetary hazards/ disasters, planetary hazards, endogenous hazards, exogenous hazards.
MODULE III	**ENDOGENOUS HAZARDS**
	Endogenous hazards, volcanic eruption, earthquakes, landslides, volcanic hazards/ disasters, causes and distribution of volcanoes, hazardous effects of volcanic eruptions, environmental impacts of volcanic eruptions. Earthquake hazards/ disasters, causes of earthquakes, distribution of earthquakes, hazardous effects of, earthquakes, earthquake hazards in India,human adjustment, perception and mitigation of earthquake.

MODULE IV	**EXOGENOUS HAZARDS**
	Exogenous hazards/disasters, infrequent events, cumulative atmospheric hazards/disasters; Infrequent events: Cyclones , lightning , hailstorms; Cyclones: Tropical cyclones and local storms, destruction by tropical cyclones and local storms (causes, distribution human adjustment, perception and mitigation); Cumulative atmospheric hazards/ disasters: Floods, droughts, cold waves, heat waves floods; Causes of floods, flood hazards India, flood control measures (human adjustment, perception and mitigation); Droughts:Impacts of droughts, drought hazards in India, drought control measures,extra planetary hazards/ disasters, man induced hazards /disasters, physical hazards/ disasters, soil erosion, Soil erosion: Mechanics and forms of soil erosion, factors and causes of soil erosion, conservation measures of soil erosion; Chemical hazards/ disasters: Release of toxic chemicals, nuclear explosion, sedimentation processes; Sedimentation processes: Global sedimentation problems regional sedimentation problems, sedimentation and environmental problems, corrective measures of erosion and sedimentation,biological hazards/ disasters, population explosion.
MODULE V	**EMERGING APPROACHES IN DISASTER MANAGEMENT**
	Emerging approaches in Disaster Management, Three Stages 1. Pre, disaster stage(preparedness) 2. Emergency Stage 3. Post Disaster stage, Rehabilitation.

TEXTBOOKS

1. PardeepSahni, "Disaster Mitigation: Experiences and Reflections", PHI Learning Pvt. Ltd., 1 st Edition, 2001.
2. J.Glynn, GaryW.HeinKe, "Environmental Science and Engineering",Prentice Hall Publishers, 2 nd Edition, 1996.

REFERENCE BOOKS:

1. R.B.Singh (Ed), "Environmental Geography", 2nd Edition, 1990.
2. R.B. Singh (Ed), "Disaster Management", 2nd Edition, 2006.
3. Donald Hyndman "Natural Hazards and Disasters" - 5th edition, 2017.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be a changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Objectives, Course Outcomes, Program Outcomes, CO-PO Mapping		
CONTENT DELIVERY (THEORY)			
2	Classify Environmental Hazards & Disasters	CO 1	T2:26.3, R2: 3.1

3	Understand the Meaning of Environmental Hazards	CO 1	T2:2.2.2
4	Understand Environmental Stress	CO 1	T2:2.2.2, R3:3.7
5	Understand Environmental stress.	CO 2	T2:2.2.2
6	Obtain knowledge on Concept of Environmental Hazards	CO 2	T1:8.1
7	Capacity to analyze Environmental stress & Environmental Disasters	CO 2	T1:7.1, R2: 1.2
8	Capacity to analyze Ecology concept	CO 2	T2:3.2.3, R2: 1.3
9	Understand Different Approaches	CO 3	T2:4.2.3
10	Understand Landscape Approach -.	CO 3	T2:4.5.2
11	Explain Ecosystem approach -Perception approach.	CO 3	T2:4.7.9
12	Understand Human ecology & its application in geographical researches	CO 4	T2:5.2.1, R2: 6.4
13	Understand Human ecology & its application in geographical researches	CO 4	T2:5.2.1, R2: 6.4
14	Understand Types of Environmental hazards & Disasters	CO 4	T2:5.4
15	Capacity to analyze and evaluate Natural hazards and Disasters	CO 3	T2:5.5.3
16	Capacity to analyze and evaluate Natural hazards and Disasters	CO 3	T2:5.5.3
17	Understand Man induced hazards & Disasters	CO 3	T2:6.2.2
18	Understand Man induced hazards & Disasters	CO 3	T2:6.2.2
19	Obtain knowledge on Natural Hazards- Planetary Hazards/ Disasters	CO 4	R1:2.5, R2: 8.2
20	Obtain knowledge on Natural Hazards- Planetary Hazards/ Disasters	CO 4	R1:2.5, R2: 8.2
21	Analyze the Planetary Hazards-Endogenous Hazards - Exogenous Hazards	CO 4	R2:2.2.5, R2: 9.2
22	Analyze the Planetary Hazards-Endogenous Hazards - Exogenous Hazards	CO 4	R2:2.2.5, R2: 9.2
23	Understand Volcanic Eruption – Earthquakes – Landslides	CO 4	R3:5.4.8, R2: 9.6
24	Understand Volcanic Eruption – Earthquakes – Landslides	CO 4	R3:5.4.8, R2: 9.6
25	Volcanic Hazards/Disasters- Causes and distribution of Volcanoes	CO 4	T2:8.1.2
26	Volcanic Hazards/Disasters- Causes and distribution of Volcanoes	CO 4	T2:8.1.2
27	Explain the Hazardous effects of volcanic eruptions	CO 4	T2:8.3.5, R2: 5.3
28	Explain the Hazardous effects of volcanic eruptions	CO 4	T2:8.3.5, R2: 5.3

29	Understand Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes	CO 4	T2:8.5
30	Understand Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes	CO 4	T2:8.5
31	Distribution of earthquakes - Hazardous effects of - earthquakes - Earthquake Hazards in India	CO 4	T2:8.9.2
32	Explain the Droughts: Impacts of droughts, Drought hazards in India	CO 5	T2:9.2, R3: 4.6
33	Explain the Droughts: Impacts of droughts, Drought hazards in India	CO 5	T2:9.2, R3: 4.6
34	Understand Extra Planetary Hazards/ Disasters- Man induced Hazards /Disasters	CO 5	T2:9.2, R3: 4.7
35	Understand Extra Planetary Hazards/ Disasters- Man induced Hazards /Disasters	CO 5	T2:9.2, R3: 4.7
36	Understand the Infrequent events: Cyclones, Lightning, Hailstorms, Cyclones: Earthquake Hazards in India	CO 5	T2:9.5.3
37	Understand the Infrequent events: Cyclones, Lightning, Hailstorms, Cyclones: Earthquake Hazards in India	CO 5	T2:9.5.3
38	Analyze the Tropical cyclones and Local storms	CO 5	T2:9.6.2, R3: 8.5
39	Understand the Destruction by tropical cyclones and local storms (causes, distribution human adjustment, perception and mitigation)	CO 5	T2:9.7.5, R3: 8.12
40	Understand the Destruction by tropical cyclones and local storms (causes, distribution human adjustment, perception and mitigation)	CO 5	T2:9.7.5, R3: 8.12
41	Analyze the Cumulative atmospheric hazards/ disasters : Floods, Droughts, Cold waves, Heat waves Floods	CO 5	T2:9.5.4
42	Analyze the Cumulative atmospheric hazards/ disasters : Floods, Droughts, Cold waves, Heat waves Floods	CO 5	T2:9.5.4
43	Identification of Flood control measures (Human adjustment, perception and mitigation),	CO 6	T2:9.5.4
44	Identification of Flood control measures (Human adjustment, perception and mitigation),	CO 6	T2:9.5.4
45	Analyze the Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters	CO 6	T2:9.5.6
PROBLEM SOLVING/ CASE STUDIES			
1	Case study on modern disaster management system	CO 1	T2:2.2.2
2	Case study on natural disaster	CO 2	T2:2.2.2
3	Case study on manmade disaster	CO 3	T2:2.2.2
2	Case study on Latur earthquake	CO 4	T2:2.2.2
4	Case study on Fukushima Nuclear disaster	CO 4	T2:2.2.2, R3:3.7
5	Case study on tsunami occurred in Japan	CO 5	T2:2.2.2

6	Case study on Hiroshima and Nagasaki	CO 4	T1:8.1
7	Case study on Russian Siberia oil spill	CO 4	T1:7.1, R2: 1.2
8	Case study on Hudhud Cyclone 2014	CO 5	T2:3.2.3, R2: 1.3
9	Case study on South India Floods 2015	CO 5	T2:4.2.3
10	Case study on Bihar Heat Wave 2019	CO 5	T2:4.5.2
11	Case study on Bihar Floods 2019	CO 5	T2:4.7.9
12	Case study on Oil Spillage in Russia 2020	CO 4	T2:5.4
13	Case study on Yellow River Flood in china	CO 4	T2:5.5.3
14	Case study on Bhola Cyclone Bangladesh	CO 5	T2:6.2.2
15	Causes of wildfires and effects	CO 4	T2:9.5.4
16	pre-disaster activities to reduce the impact of cyclones	CO 5	T2:9.5.4
17	Tectonic plate theory	CO 4	T2:9.5.6
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Different approaches and relation with human ecology, landscape approach, ecosystem approach, perception approach	CO 1	T2:2.2.2
2	Natural hazards, planetary hazards/ disasters, extra planetary hazards/ disasters, planetary hazards, endogenous hazards, exogenous hazards	CO 2	T2:2.2.2, R3:3.7
3	Effects of volcanic eruptions, environmental impacts of volcanic eruptions	CO 3, CO 4	T2:2.2.2
4	Lightning , hailstorms; Cyclones: Tropical cyclones and local storms, destruction by tropical cyclones and local storms (causes, distribution human adjustment, perception and mitigation); Cumulative atmospheric hazards/ disasters:	CO 5	T1:8.1
5	Emerging approaches in Disaster Management, Three Stages 1. Pre, disaster stage(preparedness), 2. Emergency Stage ,3. Post Disaster stage, Rehabilitation.	CO 6	T1:7.1, R2: 1.2
DISCUSSION OF QUESTION BANK			
1	Environmental hazards and disasters	CO 1	R1:2.1
2	Types of environmental hazards and disasters	CO 2	T4:7.3
3	Endogenous hazards, volcanic eruption, earthquakes, landslides, volcanic hazards/ disasters, causes and distribution of volcanoes, hazardous effects of volcanic eruptions, and their environmental impacts.	CO 3, CO 4	R2:5.1
4	Global sedimentation problems regional sedimentation problems, sedimentation and environmental problems, corrective measures of erosion and sedimentation,biological hazards/ disasters, population explosion.	CO 5	T1:7.5
5	Emerging approaches in disaster management	CO 6	T1: 4.1

Signature of Course Coordinator **HOD,CE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043
COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Course Title	**DATA MINING AND KNOWLEDGE DISCOVERY LABORATORY**				
Course Code	ACIC08				
Program	B.Tech				
Semester	VI	CSE			
Course Type	Core				
Regulation	IARE - UG 20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	0	0	0	2	2
Course Coordinator	Dr. D Durga Bhavani, Associate Professor				

I COURSE PRE-REQUISITES:

Level	**Course Code**	**Semester**	**Prerequisites**
B.Tech	AHSC08	II	Probability and Statistics
B.Tech	AITC05	IV	Database Management Systems

II COURSE OVERVIEW:

This course helps the students to practically understand a data warehouse, techniques and methods for data gathering and data pre-processing using different tools. The different data mining models and techniques will be discussed in this course. The main objective of this lab is to impart the knowledge on how to implement classical models and algorithms in data warehousing and data mining and to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering

III MARKS DISTRIBUTION:

Subject	**SEE Examination**	**CIE Examination**	**Total Marks**
Data Mining and Knowledge Discovery Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

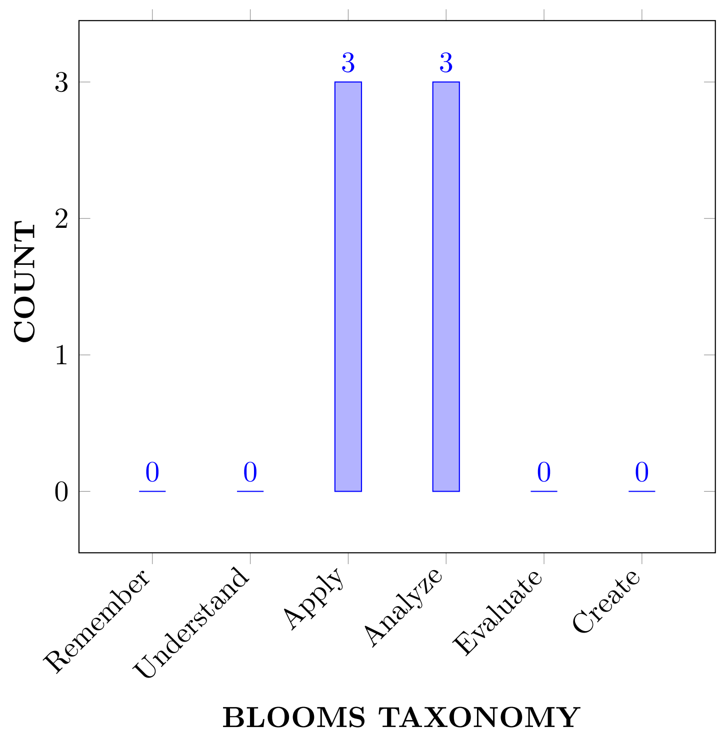
I	The Data Object Exploration and visualization
II	The pre-processing on new and existing datasets..
III	Frequent item set generation and association rules on transactional data.
IV	The data model creation by using various classification and clustering algorithms.
V	The data models accuracy analysis by varying the sample size.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Analyze** the knowledge generated from data objects, matrix operations using numpy	Analyze
CO 2	**Demonstrate** numpy module methods to categorize and corelate the raw data	Apply
CO 3	**Select** appropriate pre processing techniques to manage the missing values of data.	Apply
CO 4	**Apply** Apriori Algorithm and logistic regression for classification of data mining .	Apply
CO 5	**Identify** Classification technique from Decision Tree , Bayesian Network and Support Vector Machines to mine knowledge from pre processed data	Analyze
CO 6	**Examine** Clustering algorithms to build predication model for solving real world problem.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Lab Exercise, CIE, SEE

PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercise, CIE, SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	CIE / SEE/ Lab Exercises
PO 5	**Modern tool usage:** UCreate, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	CIE / SEE/ Lab Exercises

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		**Strength**	**Proficiency Assessed by**
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	1	Lab Exercises
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	1	Lab Exercises
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	Lab Exercises

3 = High; 2 = Medium; 1 = Low

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Courses	Program Outcomes				Program Specific Outcomes		
Outcomes	PO 1	PO 2	PO 3	PO 5	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	1	-	1
CO 2	3	1	2	1	1	-	1
CO 3	2	2	2	1	1	-	1
CO 4	3	3	2	1	1	-	1
CO 5	2	3	3	1	1	-	1
CO 6	2	1	3	1	1	-	1

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK 1	**DATA OBJECT, MATRIX OPERATIONS USING NUMPY**
	Introduction to Python libraries for Data Mining: NumPy, SciPy, Pandas, Matplotlib, Scikit, Learn a. Create multidimensional arrays and find its shape and dimension b. Create a matrix full of zeros and ones c. Reshape and flatten data in the array d. Append data vertically and horizontally e. Apply indexing and slicing on array f. Use statistical functions on array, Min, Max, Mean, Median and Standard Deviation
WEEK 2	**DATA OBJECT, MATRIX OPERATIONS USING NUMPY**
	a. Dot and matrix product of two arrays b. Compute the Eigen values of a matrix c. Solve a linear matrix equation such as 3 * x0 + x1 = 9, x0 + 2 * x1 = 8 d. Compute the multiplicative inverse of a matrix e. Compute the rank of a matrix f. Compute the determinant of an array
WEEK 3	**EXPLORATION ANDVISULIZATION OF DATA**
	Write a Python program to do the following operations: a. Loading data from CSV file b. Compute the basic statistics of given data, shape, no. of columns, mean c. Splitting a data frame on values of categorical variables d. Visualize each attribute.
WEEK 4	**EXPLORATION OF DATA, CORRILATION**
	Write a python program to load the dataset and understand the input data a. Load data, describe the given data and identify missing, outlier data items. b. Find correlation among all attributes. c. Visualize correlation matrix..
WEEK 5	**DATA PREPROCESSING – HANDLING MISSING VALUES**
	Write a python program to impute missing values with various techniques on given dataset. a. Remove rows/ attributes b. Replace with mean or mode c. Write a python program to Perform transformation of data using Discretization (Binning) and normalization (MinMaxScaler or MaxAbsScaler) on given dataset.
WEEK 6	**ASSOCIATION RULE MINING, APRIORI**
	Write a python program to find rules that describe associations by using Apriori algorithm between different products given as 7500 transactions at a French retail store. a. Display top 5 rows of data

WEEK 7	**CLASSIFICATION – DECISION TREE**
	Classification of Bank Marketing Data The data is related with direct marketing campaigns of a Portuguese banking institution. The marketing campaigns were based on phone calls. Often, more than one contact to the same client was required, in order to access if the product (bank term deposit) would be ('yes') or not ('no') subscribed. The dataset rovides the bank customers information. It includes 41,188 records and 21 fields. The classification goal is to predict whether the client will subscribe (1/0) to a term deposit (variable y). Write a python program to a. Explore data and visualize each attribute b. Predict the test set results and find the accuracy of the model c. Visualize the confusion matrix d. Compute precision, recall, F-measure and support.
WEEK 8	**CLASSIFICATION – DECISION TREE**
	Dataset: The data set consists of 50 samples from each of three species of Iris: Iris setosa, Iris virginica and Iris versicolor. Four features were measured from each sample: the length and the width of the sepals and petals, in centimeters. Write a python program to a. Calculate Euclidean Distance. b. Get Nearest Neighbors c. Make Predictions
WEEK 9	**CLASSIFICATION – DECISION TREE**
	Write a python program to a. build a decision tree classifier to determine the kind of flower by using given dimensions. b. train with various split measures (Gini index, Entropy and Information Gain) c. Compare the accuracy
WEEK 10	**CLASSIFICATION – BAYESIAN NETWORK**
	Predicting Loan Defaulters: A bank is concerned about the potential for loans not to be repaid. If previous loan default data can be used to predict which potential customers are liable to have problems repaying loans, these "bad risk" customers can either be declined a loan or offered alternative products. These files are available from the Demos directory of any IBM® SPSS® Modeler installation and can be accessed from the IBM SPSS Modeler program group on the Windows Start menu. a. Build Bayesian network model using existing loan default data b. Visualize Tree Augmented Naïve Bayes model Predict potential future defaulters and looks at three different Bayesian network model types (TAN, Markov, Markov-FS) to establish the better predicting model.

WEEK 11	**CLASSIFICATION – SUPPORT VECTOR MACHINES (SVM)**
	A multi, class classification problem on the cancer dataset. This dataset is computed from a digitized image of a fine needle aspirate (FNA) of a breast mass. They describe characteristics of the cell nuclei present in the image. The dataset comprises 30 features (mean radius, mean texture, mean perimeter, mean area, mean smoothness, mean compactness, mean concavity, mean concave points, mean symmetry, mean fractal dimension, radius error, texture error, perimeter error, area error, smoothness error, compactness error, concavity error, concave points error, symmetry error, fractal dimension error, worst radius, worst texture, worst perimeter, worst area, worst smoothness, worst compactness, worst concavity, worst concave points, worst symmetry, and worst fractal dimension) and a target (type of cancer). Use:scikit, learn Build a model to classify the cancer data as malignant (harmful) and benign (not harmful) using SVM. This model can use the features of cancer patients data and to give an early indication of whether their samples might be benign or malignant. Hint: Refer UCI Machine Learning Repository for data set or load from scikit learn library
WEEK 12	**CLUSTERING – K- MEANS**
	Predicting the titanic survive groups: The sinking of the RMS Titanic is one of the most infamous shipwrecks in history. On April 15, 1912, during her maiden voyage, the Titanic sank after colliding with an iceberg, killing 1502 out of 2224 passengers and crew. This sensational tragedy shocked the international community and led to better safety regulations for ships. One of the reasons that the shipwreck led to such loss of life was that there were not enough lifeboats for the passengers and crew. Although there was some element of luck involved in surviving the sinking, some groups of people were more likely to survive than others, such as women, children, and the upper-class. Libraries: Pandas, NumPy, Sklearn, Seaborn, Matplotlib Write a python program a. to perform preprocessing. b. to perform clustering using k-means algorithm to cluster the records into two i.e., the ones who survived and the ones who did not.

REFERENCE BOOKS:

1. J.Han,M.Kamber, —Data Mining: Concept and Techniques‖, Academic Press, Morgan Kanfman Publishers, 3 rd Edition, 2008.
2. Robert Layton, "Learning Data Mining with Python",Packt Publishing, 2015.
3. PieterAdrians, DolfZantinge, —Data Mining‖, Addison Wesley, Peter V, 2000.

WEB REFERENCES:

1. https://www.dataquest.io/blog/sci-kit-learn-tutorial/
2. https://archive.ics.uci.edu/ml/datasets.php/
3. https://www.datacamp.com/community/tutorials/svm-classification-scikit-learn-python

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Data Object, Matrix Operations Using Numpy..	CO 1	R1: 1.1
2	Data Object, Matrix Operations Using Numpy.	CO 1	R1: 2.3
3	Exploration And visulization Of Data	CO 1,CO 2	R1: 4.1
4	Exploration Of Data, Corrilation	CO 1,CO 2	R1: 5.1
5	Data Preprocessing –Handling Missing Values	CO 3	R2: 6.1
6	Association Rule Mining,Apriori.	CO 4	R1: 7.1
7	Classification – Decision Tree.	CO 5	R2: 11.4
8	Classification – Decision Tree	CO 5	R1: 12.5
9	Classification – Decision Tree.	CO 5	R2: 14.3
10	Classification – Bayesian Network	CO 5,	R1: 15.1
11	Classification – Support Vector Machines (SVM)	CO 5	R 2: 16.4
12	Clustering – K- Means	CO 6	R 1: 20.5

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Finding Association Rules for buying data.
2	Credit Risk Assessment. Sample Programs using German Credit Data
3	Write a procedure for Visualization of Weather Table

Signature of Course Coordinator **HOD, CSE**
Dr.D.Durga Bhavani, Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE ENGINEERING

COURSE DESCRIPTION

Course Title	**SOFTWARE TESTING LABORATORY**				
Course Code	ACIC09				
Program	B.Tech				
Semester	VI	CSE			
Course Type	Core				
Regulation	IARE - UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	2
Course Coordinator	Mr.A.Suresh Babu, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC04	II	Programming for Problem Solving using C
B.Tech	ACSC19	V	Object Oriented Software Engineering
B.Tech	AITC09	V	Web Application Development

II COURSE OVERVIEW:

Software testing improves the quality of software and provides error free software. This course provides the hands on experience on an automated and manual testing techniques such as black-box, data flow, path and transaction testing. The demonstration on bug tracking and automated test management tools. Testing is major part in software development life cycle and used in real time applications like banking, flight reservation system etc.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Software Testing Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

X	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria.

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

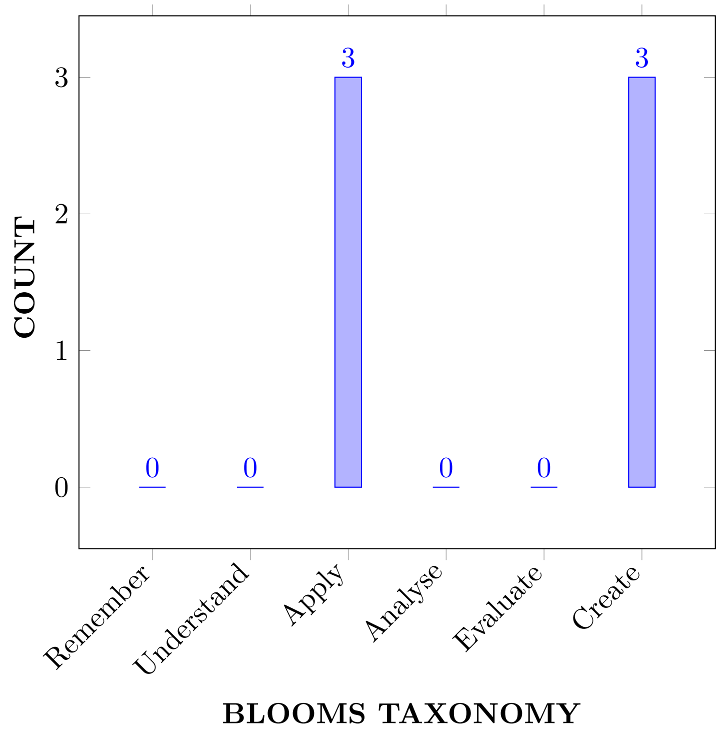
I	The importance of web testing tool and bug tracking tool.
II	How to develop test case and test plan document for any real time application.
III	How to write system specifications of any application and report various bugs in it.
IV	How to use automated functional testing tool like Quick Test Professional.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Make use of** Conditional statements for verifying the logical behavior of the system. .	Apply
CO 2	**Choose** the test director tool for effective test management in specific to the application.	Apply
CO 3	**Build** a Test Plan which helps us to validate the quality of the application.	Create
CO 4	**Design** a test cases by using the specific behaviour of the system.	Create
CO 5	**Create** test life cycle of application using bug bug zilla and bug bit tools	Create
CO 6	**Develop**Automated Functional Test for given application.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations

Program Outcomes	
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Lab Experiments / CIE / SEE
PO 2	**Problem analysis**:Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	Lab Experiments / CIE / SEE
PO 3	**Design/Development of Solutions**: Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.	3	Lab Experiments / CIE / SEE

PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	Lab Experiments / CIE / SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations.	3	Lab Experiments / CIE / SEE
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	Lab Experiments/ CIE / SEE
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	Lab Experiments/ CIE / SEE
PO 12	**Life-long learning:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations.	2	Lab Experiments / CIE / SEE

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	3	Lab Programs / CIA/SEE
PSO 2	Focus on improving software reliability, network security or information retrieval system	3	Lab Programs / CIA/SEE
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	Lab Programs / CIA/SEE

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE	PROGRAM OUTCOMES												PSO'S		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	✓	-	-	-	✓	-	-	-	-	-	-	-	-	-	-
CO 2	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	-	-

CO 4	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	-	-
CO 5	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	-	-
CO 6	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	✓

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Make use of the following conditional statement if , if else, for, while and switch case to find the solution of **engineering fundamentals, and an engineering specialization** to the solution of **complex engineering problems.**	3
	PO 5	Make use of the following conditional statement if , if else, for, while and switch case to find the solution of **modern tool usage.**	1
CO 2	PO 1	Choose the test director tool for effective test management in any kind of application in **engineering fundamentals,** and an **engineering specialization** to the solution of **engineering problems.**	3
CO 3	PO 1	**(Bulid)**a Test Plan which helps us to validate the quality of the application for finding the solution of **complex engineering.**	2
CO 4	PO 3	**(Design)** the knowledge of functional behaviour of the system for designing a test case for finding the solution of **complex engineering problems.**	1
	PO 5	**Apply** the knowledge of functional behaviour of the system for designing a test case for **design next-generation computer systems, networking devices, search engines.** or processes that meet the specified needs with appropriate consideration for the **public safety.**	3
CO 5	PSO 1	**Apply** the knowledge of functional behaviour of the system for designing a test case for **design next-generation computer systems, networking devices, search engines.**	3
	PSO 1	**Create** the process of test life cycle by using different bug tracking tools using bugzilla and bugbit **for designing next-generation computer systems, networking devices and web browsers.**	3
CO 6	PO 1	**(Create)** the process of Automated Functional Testing Tool using Quick test professional by applying the **knowledge of engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.**	3
	PSO 3	**Create** the process of Automated Functional Testing Tool using Quick test professional **for designing solutions for complex engineering problems.**	1

XIII MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

COURSE	Program Outcomes/ No. of Key Competencies Matched												PSO'S		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	-	-	-	1	-	-	-	-	-	-		-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	1	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO 4	1	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO 5	1	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO 6	3	-		-	-	-	-	-	-	-	-	-	-	-	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE	Program Outcomes/ No. of Key Competencies Matched												PSO'S		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	1	1	1
CO 1	100	-	-	-	33	-	-	-	-	-	-	-	-	-	-
CO 2	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	33	-	-	-	100	-	-	-	-	-	-	-	100	-	-
CO 4	33	-	-	-	100	-	-	-	-	-	-	-	100	-	-
CO 5	33	-	-	-	100	-	-	-	-	-	-		100	-	-
CO 6	100	-	-	-	-	-	-	-	-	-	-	-	-	-	33

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0≤ C≤ 5% – No correlation

1 - 40 % <C < 60% –Moderate

2 - 5% <C≤ 40% – Low/ Slight

3 - 60% ≤ C < 100% – Substantial /High

COURSE	PROGRAM OUTCOMES												PSO'S		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	-	-	-	-	-	-	-	-	-	-	-	-	2	2	1
CO 2	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2
CO 3	2	-	-	-	-	-	-	-	-	-	-	-	2	2	1
CO 4	-	-	-	-	-	-	-	-	1	-	-	-	2	2	2
CO 5	-	-	-	-	-	-	-	-	-	1	-	-	2	2	3
CO 6	-	-	1	2	-	1	1	1	2	-	-	2	2	2	1

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

Week-I	**CONSTRUCTS**
	Write programs in C language to demonstrate the working of the following constructs: a) while b) switch c) for d) if-else e) do-while
Week-II	**SYSTEM SPECIFICATIONS**
	a. Study the system specifications of ATM system and report various bugs in it. b. Study the system specifications of banking application and report various bugs in it.
Week-III	**TEST CASES**
	a. Write the test cases for ATM system. b. Write the test cases for banking application.
Week-IV	**TEST PLAN**
	Create a test plan document for any application (e.g. Library management system).
Week-V	**TESTING TOOL**
	Study of any testing tool (e.g. Win runner).
Week-VI	**SELENIUM**
	Study of web testing tool (e.g. Selenium).
Week-VII	**BUG TRACKING TOOL**
	Study of bug tracking tool (e.g. Bugzilla).
Week-VIII	**BUGBIT**
	Study of bug tracking tool (e.g. Bugbit).
Week-IX	**TEST MANAGEMENT TOOL**
	Study of any test management tool (e.g. Testdirector).
Week-X	**OPEN SOURCE TESTING TOOL**
	Study of any Open Source Testing Tool (e.g. Test Link).

Week-X1	**AUTOMATED FUNCTIONAL TESTING TOOL**
	Study of QTP (Quick Test Professional) automated functional testing tool.
Week-XII	**INTROSPECTION OF MATRIX MULTIPLICATION**
	A program written in C language for matrix multiplication fails, introspect the causes for its failure and write down the possible reasons for its failure.

TEXT BOOKS:

1. Boris Beizer, Software Testing Technique, DreamTech Press, 2nd Edition, 2000.
2. Dr. K. V. K. K. Prasad, Software Testing Tools, DreamTech Press, Revised Edition, 2004.
3. Perry, Effective methods of Software Testing, John Wiley, 2nd Edition, 1999.

REFERENCE BOOKS:

1. Paul Jorgensen, Software Testing: A Craftsman's Approach, Auerbach Publications, 3rd Edition, 2012.
2. http://2. P. C. Jorgensen, Software Testing, Auerbach Publications, 3rd Edition, 2000.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Constructs.	CO 1	T1
2	System Specifications	CO 2	T1
3	Test Cases	CO 3	T1,T2
4	Test Plan	CO 3, CO 4	T1,T2
5	Testing Tool	CO 4, CO 5	T1,W1
6	Selenium	CO1, CO3	T1,W2
7	Bug Tracking Tool	CO 5	T1,W3
8	Bugbit	CO 5	T2,W3
9	Test Management Tool	CO 4	T2,W2
10	Open Source Testing Tool	CO 5	T2,W5
11	Automated Functional Testing Tool	CO 4, CO 6	T2,W2
12	Introspection of Matrix Multiplication	CO 1	T1,W5

XX EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Develop and design FTP test plan using JMeter.
2	Design and develop how to do performance testing using testing tool JMeter.
3	Design the test cases for any application using automated testing.
4	Design the Dynamic Web Tables Using Selenium WebDriver.
5	Develop defect Management Process in Software Testing.

Signature of Course Coordinator **HOD,CSE**
Mr.A.Suresh Babu, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**
Course Title	**BIG DATA AND ANALYTICS**
Course Code	ACSC31
Program	B.Tech
Semester	VII
Course Type	Core
Regulation	UG-20

Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	0	3	-	-

Course Coordinator	Ms. K Mayuri,Assistant Professor

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITC05	IV	Database Management Systems
B.Tech	ACIC01	VI	Data Mining and Knowledge Discovery

II COURSE OVERVIEW:

This course provides a clear understanding on concepts of sources of big data, characteristics, storing and processing components, and analytics applications. This course emphasizes on potential impact of big data challenges, open research issues, and various tools associated with it. This course includes the introduction and processing big data with an overview of Hadoop technology and its components such as pig, hive, etc.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Big Data and Analytics	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	x	Chalk & Talk	x	Assignments	✓	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
50%	Understand
33.3%	Apply
16.6%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open-ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

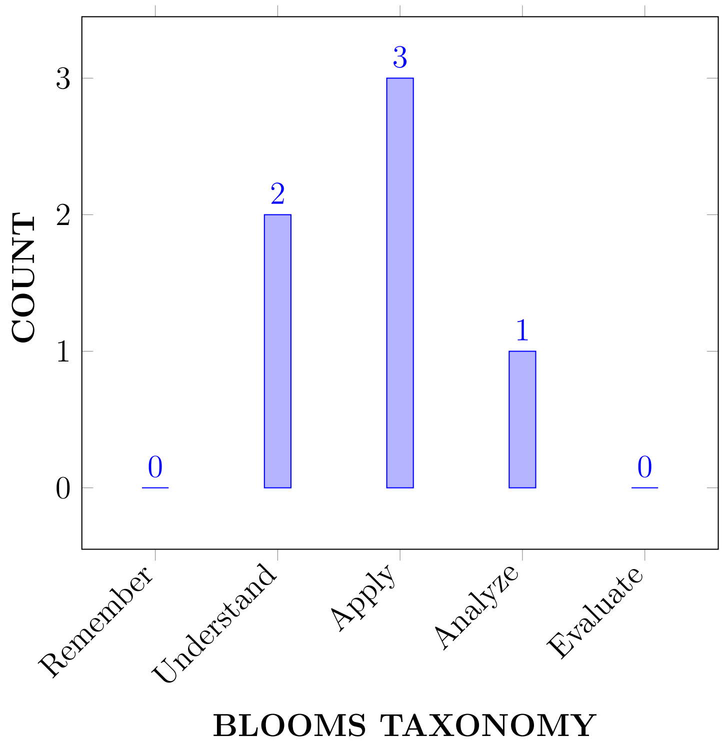
I	The scope and essentiality of Big Data and Business Analytics.
II	The technologies used to store, manage, and analyze big data in a Hadoop ecosystem.
III	The techniques and principles in big data analytics with scalability and streaming capability.
IV	The hypothesis on the optimized business decisions in solving complex real-world problems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** the evolution of big data and big data analytics along with its characteristics and challenges included in traditional business intelligence.	Understand
CO 2	**Make use of** appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data	Apply
CO 3	**Develop** a Map Reduce application for optimizing the jobs.	Apply
CO 4	**Develop** the applications for handling huge volume of data using Pig Latin.	Apply
CO 5	**Explain** the importance of bigdata framework HIVE and its built-in functions, data types and services like DDL in Hadoop distributed file system.	Understand
CO 6	**Extend** the big data technologies used to process and querying the bigdata in Hadoop, MapReduce, Pig and Hive.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Program Outcomes	
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	CIE/Quiz/AAT
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	1	Assignments/ SEE /CIE,AAT, QUIZ
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	Assignments/ SEE /CIE,AAT, QUIZ
PO 12	**Life - Long Learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	SEE/ CIE, AAT, QUIZ

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	Research papers/ Group discussion/ Short term courses
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	2	Research papers/ Group discussion/ Short term courses
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	3	Research papers/ Group discussion/ Short term courses

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 2	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 3	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓-	✓	✓
CO 4	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 5	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 6	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Compare big data analysis and analytics in optimizing business decisions **knowledge** by using the **mathematical principles** and **computer science methodologies**.	3
	PO 2	Explain the evolution of big data and big data analytics along with its characteristics the **problem** and challenges includes the **problem statement,data collection ,validation** and **documentation** in traditional business intelligence.	5
	PO 3	Explain the evolution of big data in **knowledge and understanding** the big data analytics along with its characteristics and **understand** and **manage**challenges included in traditional business intelligence in **engineering process**.	4
	PO 5	Explain the evolution of big data and big data analytics along with its characteristics and challenges included in traditional business intelligence in **computer software**.	1
	PO 10	Explain the evolution of big data and big data analytics along with its characteristics in**clarity** and also challenges included in traditional business intelligence in **reference**.	2
	PO 12	**keeping trend in CSE** Explain the evolution of big data and big data analytics along with its characteristics in **personal continuing** and **on going learning** in challenges included in traditional business intelligence in **project management**.	4
	PSO 1	Explain the evolution of big data and big data analytics along with its characteristics and challenges in **search engines ,next generation computer systems,networking devices**,included in traditional business intelligence in **knowledge discovery tools**.	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 2	Explain the evolution of big data and big data analytics along with its characteristics and challenges in **mobile and web application development** included in traditional business intelligence.	2
	PSO 3	Explain the evolution of big data and big data analytics along with its characteristics and challenges included in traditional business intelligence in **practical experience in shipping real world software ,using industry standard tools**.	2
CO 2	PO 1	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data by **applying mathematical principles,scientific methodology,computer science**	3
	PO 2	**identify problem,problem statement** and Make use of appropriate components for processing, scheduling and knowledge extraction to **validate the data** from large volumes for applications to handling huge volume of data in **information and data collection** in **documentation**	7
	PO 3	**Investigate and define a problem identification** appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data **to manage the design process**	4
	PO 5	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data in **computer software**	1
	PO 10	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes in **clarity** the applications for handling huge volume of data with **reference**	2
	PO 12	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data **In personal continued and ongoing learning**	3
	PSO 1	Make use of Hadoop components on huge volume data used to develop analytical solutions related to **Bigdata, Artificial Intelligence, Machine Learning and Networking**.	4
	PSO 2	Make use of Hadoop components on huge volume data used to develop analytical solutions related to **mobile and web application in emerging technologies**.	3
	PSO 3	Make use of Hadoop components on huge volume data used to develop analytical solutions related to**using industry standard tools and collabaration**.	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 3	PO 1	Apply scientific **principles and methodologies, other engineering disciplines** in map reduce, Hadoop.	3
	PO 2	**Problem** Analysis in map reduce,**problem statement,datacollection,validation,documentation** in Hadoop.	5
	PO 3	Get the **knowledge and understanding** of a Map Reduce application **understand** and **manage** for optimizing the jobs in **engineering process**.	5
	PO 5	Develop a Map Reduce application for optimizing the jobs in **computer software**.	1
	PO 12	**keeping trend in CSE** Develop a Map Reduce application for optimizing the jobs in **personal continuing,on going learning, project management**.	4
	PSO 1	Develop a Map Reduce application for optimizing the jobs in **Big data,Artificial Intelligence,Machine learning**.	3
	PSO 2	Develop a Map Reduce application for optimizing the jobs in **mobile and web application in emerging technologies**.	1
	PSO 3	Develop a Map Reduce application for optimizing the jobs related to using **industry standard tools**	1
CO 4	PO 1	Apply **scientific principles and methodologies, other engineering disciplines** to applications for handling huge volume of data using Pig Latin.	3
	PO 2	Analyze **problem,problem statement** in applications for handling huge volume of data using Pig Latin in **data collection,validation,documentation**.	5
	PO 3	**Conduct investigation of complex problems** for developing virtual machines using **knowledge of process, laboratory skills, understanding knowledge and ability to apply a systems approach** application for handling huge volume of data using Pig Latin.	4
	PO 5	Develop the applications for handling huge volume of data using Pig Latin in **computer software**.	1
	PO 10	Develop the applications with **clarity** for handling huge volume of data using Pig Latin with **reference**.	2
	PO 12	**Keeping current in CSE and advanced engineering concepts** of advanced applications for handling huge volume of data using Pig Latin in **personal continuing,on going,project management**	4
	PSO 1	**Understand, Design and Analyze Computer Programs** used in applications for handling huge volume of data using Pig Latin.	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 2	**Focus on improving Network Security and IRS** in developing applications for handling huge volume of data using Pig Latin.	1
	PSO 3	Develop the applications for handling huge volume of data using Pig Latin in **Industry standard tools and collabaration** .	1
CO 5	PO 1	Understand the importance of big data framework HIVE by using **computer science methodologies, mathematical and scientific principles**.	3
	PO 2	Demonstrate the HIVE functions and services for specific problems by including huge volume of **information and data collection, file structure translation, validation and solution development with proper documentation**.	5
	PO 3	Explain the HIVE application process by including **various problems, customer and user needs, with cost effective and creative solutions by managing the design process, knowledge on economic context, management techniques**.	5
	PO 5	Explain the HIVE application process by **computer software**.	1
	PO 10	the importance of bigdata framework HIVE and its built-in functions, data types and services like DDL in **clarity** DDLin Hadoop distributed file system in **reference**	2
	PO 12	**keeping trend in CSE** Explain the HIVE application in **personal continuning** and **On going learning** process by **project management**.	4
	PSO 1	Explain the HIVE features and services for analyzing programs in the areas related to **Algorithms, Bigdata, Artificial Intelligence, Machine Learning and Networking**.	4
	PSO 2	Explain the HIVE features and services for analyzing programs in the areas related to **Mobile and web applicatin in emerging technologies** .	3
	PSO 3	Explain the HIVE features and services for analyzing programs in the areas related to **Industry standard tools and collabaration** .	2
CO 6	PO 1	Explain the big data technologies used to process and querying the bigdata by **applying mathematical principles and computer science methodologies**	3
	PO 2	Understand the **problem** and develop solutions using **big data technologies and document the results for interpretation**	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	Identify the appropriate technology like pig, hive etc. suitable for **various problems, by understanding customer and user needs, with cost effective and creative solutions by managing the design process, knowledge on economic context, management techniques**.	4
	PO 5	Identify the appropriate technology like pig, hive etc. suitable for **computer software**	1
	PO 10	Identify the appropriate technology like pig, hive etc in **clarity**. with suitable examples for **Reference**	2
	PO 12	**keeping current in CSE and advanced engineering concepts**Identify the appropriate technology like pig, hive etc in **personal continuing ,on going,project management**.	7
	PSO 1	Explain the big data technologies used to process and querying the bigdata in the areas related to **Algorithms, Bigdata, Artificial Intelligence, Machine Learning and Networking**.	4
	PSO 2	Explain the big data technologies used to process and querying the bigdata in the areas related to**Mobile and web applicatin in emerging technolgies**.	4
	PSO 3	Explain the big data technologies used to process and querying the bigdata in the areas related to **Industry standard tols and collabaration**.	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	Program Outcomes/ No. of Key Competencies Matched												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	6	2	3
CO 1	3	4	4	-	1	-	-	-	-	2	-	4	4	2	2
CO 2	3	7	4	-	1	-	-	-	-	2	-	5	4	2	2
CO 3	3	4	4	-	1	-	-	-	-	2	-	4	4	2	2
CO 4	3	4	4	-	1	-	-	-	-	2	-	4	3	1	2
CO 5	3	4	4	-	1	-	-	-	-	2	-	5	4	2	2
CO 6	3	4	4	-	1	-	-	-	-	2	-	4	3	2	2

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	40	40	-	100	-	-	-	-	40	-	50	66.6	100	66.6
CO 2	100	70	40	-	100	-	-	-	-	40	-	62.5	66.6	66.6	40

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 3	100	40	40	-	100	-	-	-	-	40	-	50	66.6	60	60
CO 4	40	40	40	-	100	-	-	-	-	40	-	50	40	60	40
CO 5	100	40	40	-	100	-	-	-	-	40	-	62.5	40	60	40
CO 6	100	40	40	-	100	-	-	-	-	40	-	50	40	60	60

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -$5 < C \leq 40\%$ – Low/ Slight

2 - $40\ \% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	3	-	-	-	-	2	-	2	3	2	2
CO 2	3	3	2	-	3	-	-	-	-	2	-	3	3	2	2
CO 3	3	2	2	-	3	-	-	-	-	2	-	2	3	2	1
CO 4	3	2	2	-	3	-	-	-	-	2	-	2	2	2	1
CO 5	3	2	2	-	3	-	-	-	-	2	-	3	3	1	1
CO 6	3	2	2	-	3	-	-	-	-	2	-	2	2	3	2

XVI ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVII SYLLABUS:

MODULE-I	**INTRODUCTION TO BIG DATA**
	Introduction to Big data: Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, Traditional Business Intelligence (BI) versus Big Data. Big data analytics: Classification of Analytics, Importance and challenges facing big data, Terminologies Used in Big Data Environments, The Big Data Technology Landscape.
MODULE II	**INTRODUCTION TO HADOOP**
	Introducing Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges, History and overview of Hadoop, Use Case of Hadoop, Hadoop Distributors, Processing Data with Hadoop, Interacting with Hadoop Ecosystem.

MODULE III	**THE HADOOP DISTRIBUTED FILESYSTEM**
	Hadoop Distributed File System (HDFS): The Design of HDFS, HDFS Concepts, Basic Filesystem Operations, HadoopFilesystems. The Java Interface- Reading Data from a Hadoop URL, Reading Data Using the File system API, Writing Data. Data Flow- Anatomy of a File Read, Anatomy of a File Write, Limitations.
MODULE IV	**UNDERSTANDING MAP REDUCE FUNDAMENTALS**
	Map Reduce Framework: Exploring the features of Map Reduce, Working of MapReduce, Exploring Map and Reduce Functions, Techniques to optimize MapReduce jobs, Uses of MapReduce .Controlling MapReduce Execution with Input Format, Reading Data with Custom Record Reader, -Reader, Writer, Combiner, Partitioners, MapReduce Phases, Developing simple MapReduce Application.
MODULE V	**INTRODUCTION TO PIG AND HIVE**
	Introducing Pig: Pig architecture, Benefits, Installing Pig, Properties of Pig, Running Pig, Getting started with Pig Latin, working with operators in Pig, Working with functions in Pig. Introducing Hive: Getting started with Hive, Hive Services, Data types in Hive, Built-in functions in Hive, Hive DDL.

TEXTBOOKS

1. Seema Acharya, Subhashini Chellappan, —Big Data and Analytics, Wiley Publications, 2nd Edition,2014DT Editorial Services, —Big Data, Dream Tech Press, 2nd Edition, 2015.
2. Tom White, —Hadoop: The Definitive Guide, O'Reilly, 3rd Edition, 2012.
3. Black Book Big Data, dreamtech publications, 1st Edition, 2017

REFERENCE BOOKS:

1. Michael Minelli, Michele Chambers, Ambiga Dhiraj, —Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Wiley CIO Series, 1st Edition, 2013.
2. Rajiv Sabherwal, Irma Becerra- Fernandez, —Business Intelligence –Practice, Technologies and Management, John Wiley, 1st Edition, 2011.
3. Arvind Sathi, —Big Data Analytics: Disruptive Technologies for Changing the Game, IBM Corporation, 1st Edition, 2012.

XVIII COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	https:// lms. iare.ac.in /index ? route= course/ details& course id=84
CONTENT DELIVERY (THEORY)			
1	Define big data and its importance.	CO 1	T1:2.3
2	Describe the elements of big data-volume, variety, velocity and veracity	CO 1	T1:2.1, 2.5
3	Understand the life cycle of big data	CO 1	T1:2.4
4	Define the importance and challenges of big data.	CO 1	T1:2.5 – 2.6 R2:21.51
5	Understand Traditional Vs Big Data Business Approach	CO 1	T1:2.9
6	Classify the Big data analytics - Classification of Analytics	CO 1	T1:3.1 R2:21.51
7	Importance and challenges facing big data,	CO 2	T1:3.7 -3.8
8	Explain the terminologies Used in Big Data Environments	CO 2	T1:3.12 R2:21.55
9	Explain the Big Data Technology Landscape with Hadoop ecosystem.	CO 3	T1:4.1 – 4.2 R2:21.58
10	Understand the core components of Hadoop-big data.	CO 3	T2:26.16 R2:21.61
11	Outline Hadoop ecosystem and Computing Challenges, RDBMS versus Hadoop	CO 3,CO 4	T1:5.1 – 5.5 R2:21.24
12	Differentiate between RDBMS and Hadoop	CO 3,CO 4	T1:5.1 – 5.5 R2:21.24
13	Recall the history and overview of Hadoop	CO 3,CO 4	T1:5.5 R2:21.29
14	Demonstrate the real time use case in Hadoop	CO 4	T1:5.6 – 5.7 R2:21.31
15	Explain Hadoop Distributors and processing Data with Hadoop	CO 4,CO 5	T1:5.8 R2:21.33
16	Summarize the other components in Hadoop Interacting in Hadoop Ecosystem	CO 4,CO 6	T1:5.9

17	Explain the Design concepts of HDFS	CO 5	T1:5.11 R2:21.64
18	Discuss the Basic Filesystem Operations	CO 4,CO 6	T1:5.10-5.13 T2:3
19	Recall the Hadoop Filesystem operations.	CO 4,CO 6	T1:5.10-5.13 T2:3
20	Find differences between Basic Filesystem Operations and Hadoop Filesystems.	CO 4,CO 6	T1:5.10-5.13 T2:3
21	Explain the Java Interface for Reading Data from a Hadoop URL Using the Filesystem API	CO 4,CO 6	T2:3
22	Explain Writing Data and Data Flow- Anatomy of a File Read, Anatomy of a File Write, Limitations	CO 4,CO 6	T1:5.10 T2:3
23	Explain the Anatomy of a File Write, Limitations	CO 4,CO 6	T1:5.10 T2:3
24	Explore the features of MapReduce and Map and Reduce Functions	CO 4	T1:8.1-8.3 T2:8
25	Explore Map and Reduce Functions	CO 4	T1:8.1-8.3 T2:8
26	Outline the techniques to optimize MapReduce jobs and uses	CO 4,	T2:27.8
27	List out the uses of MapReduce	CO 4,	T2:27.8
28	Illustrate the controlling MapReduce Execution with Input Format	CO 4,CO 6	T2:7
29	Explain the reading Data with custom Record Reader	CO 5	T1:8.2 – 8.3
30	Explain the reading Data with Reader, Writer, Combiner	CO 5	T1:8.2 – 8.3
31	Explain the reading Data with Practitioners, MapReduce Phases	CO 5	T1:8.2 – 8.3
32	Develop a simple MapReduce Application	CO 6	T1:8.4 – 8.8
33	Explain Pig architecture	CO 5	T1:10.1-10.6
34	Demonstrate the benefits of pig	CO 4, CO 5	T2:11
35	Summarize the Installation process of Pig	CO 4, CO 5	T2:11
36	List out the properties of pig	CO 4, CO 5	T2:11
37	Demonstrate of running pig	CO 4, CO 5	T2:11
38	Demonstrate of pig Latin and Getting started with Pig Latin	CO 4, CO 5	T2:11
39	Develop applications by working with operators in Pig, Working with functions in Pig.	CO 6	T1:10.7-10.12
40	Develop applications by working with functions in Pig.	CO 6	T1:10.7-10.12
41	Explain the Hive component	CO 4	T1:9.1-9.2 T2:12
42	Explore the Services on hive component	CO 4	T1:9.1-9.2 T2:12
43	List out Hive Data types, Built-in functions, and Hive DDL.	CO 6	T1:9.3-9.8

44	Discuss Built-in functions of Hive.	CO 6	T1:9.3-9.8
45	Demonstrate the Hive DDL.	CO 6	T1:9.3-9.8
PROBLEM SOLVING/ CASE STUDIES			
1	Develop a simple MapReduce Application	CO3	R2:7.5
2	Explain Pig architecture	CO5	T2:3
3	Summarize Installation process of Pig along with Properties and getting started with Pig Latin.	CO5	R2:7.5
4	Develop applications by working with operators in Pig, Working with functions in Pig.	CO 5	R2:7.5
5	Explain the Hive component and Hive Services	CO 2	T1:4.1
6	Demonstrate Hive Data types, Built-in functions and Hive DDL.	CO 2	T3:4.5
7	Features of Hadoop explain in detail	CO 1	R4:5.2
8	Findingthe differences between Hadoop and Big Data	CO 1	T2:5.2
9	Describe Map Reduce Architecture	CO 3	R2:7.5
10	Challenges of Big data and Business analytics .	CO 1	R2:7.5
11	Features of Hadoop vs SQL	CO 2	R2:7.5
12	Describe Job Tracker and Task Tracker	CO 3	R2:7.5
13	Explain PIG, components of PIG and HIVE	CO 4	R2:7.5
14	Explain word count using pig scripting language	CO 6	R2:7.5
15	Difference between Pig Latin and Apache with example	CO 6	R2:7.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Big data,Business Analytics,types of Structured data	CO 1	R4:2.1
2	Features of Hadoop Distributed File System,Key Distinctions of Hadoop, Hadoop Components	CO 2	R4:2.1
3	Comparing FS and HDFS,Hadoop Cluster,Hadoop vs SQL	CO 3	R4:2.1
4	Definitionof map reduce,Map reduce architecture	CO 4	R4:2.1
5	Pig components and pig tutorial,pig Latin data language,characteristics of Apache	CO 5	R4:2.1
DISCUSSION OF QUESTION BANK			
1	Explanation about the bigdata and its challenges	CO 1,2	R4:2.1
2	Summarize about the hadoop distributed file system in hadoop	CO 3	T4:7.3
3	Summarize the other components in Hadoop Interacting in Hadoop Ecosystem	CO 4	R4:5.1
4	Outline the techniques to optimize MapReduce jobs and uses	CO 5,6	T1:7.5
5	Demonstrate pig and Hive Data types, Built-in functions and Hive DDL.	CO 6	T1: 4.1

Signature of Course Coordinator **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**CLOUD APPLICATION DEVELOPMENT**				
Course Code	ACSC30				
Program	B.Tech				
Semester	VII				
Course Type	CORE				
Regulation	UG 20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms K.Rashmi , Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITB04	IV	Operating Systems
B.Tech	ACSB08	IV	Database Management Systems
B.Tech	AITB10	V	Computer Networks

II COURSE OVERVIEW:

This Course emphasizes on transformation of the IT industry with high elastic scalability (EC) in the delivery of enterprise applications and capabilities across the various cloud service models. This course covers the concepts of cloud infrastructures, cloud service providers, virtualization, software-defined networks and cloud storage, cloud resource scheduling and management, programming models, and cloud security.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Cloud Application Development	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	White board	x	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
50%	Understand
33.3%	Apply
16.6%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

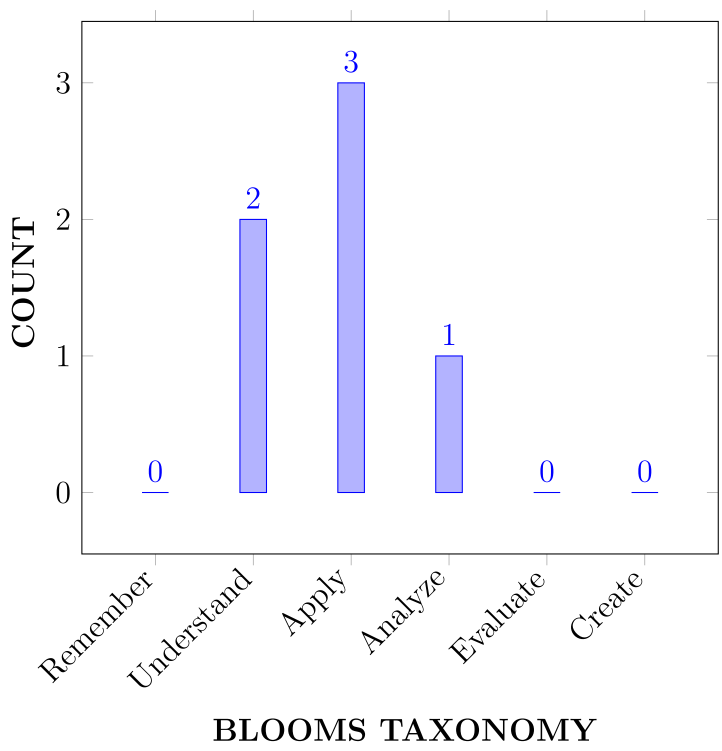
I	The fundamental concepts of various services deployed with cloud models for solving current and future challenges.
II	The principles in data centre design and services provided with virtualization techniques.
III	The scaling and load balancing solutions for developing business models with appropriate cloud infrastructure, services and programming models.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Choose** appropriate CSP based on user demanded services among AWS, GCP, MS Azure, and Apache Cloud Stack.	Apply
CO 2	**Identify** the cloud architecture style and infrastructure in providing services with high elastic scalability as per user requirement.	Apply
CO 3	**Summarize** Virtual Machine concepts for running different applications on different operating systems concurrently.	Understand
CO 4	**Make use of** resource scheduling and management methods for finding the best match of combined resources as per user requirement.	Apply
CO 5	**Outline** system security issues and vulnerabilities for reducing system-specific attacks under a virtualization environment.	Understand
CO 6	**Inspect** various cloud services, programming models for developing a business model according to customer requirements.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIA/SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIA/SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	CIA/SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations	3	CIA/SEE
PO 10	**Communication:**Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	Tech Talk/Concept Videos
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	Tech Talk/Concept Videos

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	3	CIA/SEE
PSO 2	Focus on improving software reliability, network security and information retrieval systems.	3	CIA/SEE
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	CIA/SEE

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	-	-	-	-	-	-	-	✓	-	✓	-	-	✓
CO 2	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	-	✓	✓
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	-	✓	-
CO 4	✓	✓	✓	-		-	-	-	-	✓	-	✓	✓	✓	✓
CO 5	✓	-	-	-	-	-	-	-	-	✓	-	✓	-	✓	-
CO 6	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Apply scientific principles and methodologies, other engineering disciplines in selection of best cloud service provider based on customer requirements.	2
	PO 2	Problem Analysis in selection of best cloud service provider based on customer requirements	7
	PO 10	Subject matter and speaking style assessed in explanation of selecting best cloud service provider based on customer requirements	2
	PO 12	Keeping current in CSE and advanced engineering concepts in selecting best cloud service provider based on customer requirements	1
	PSO 3	Make use of modern computer tools for selecting best cloud service provider based on customer requirements	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 2	PO 1	Apply scientific principles and methodologies, other engineering disciplines to select infrastructures and architectural styles of the system as per cloud user and organizational requirements.	2
	PO 2	Problem Analysis in selecting infrastructures and architectural styles of the system as per cloud user and organizational requirements.	9
	PO 3	Design solutions for architectural styles and infrastructure for providing services with high elastic scalability as per user requirement.	8
	PO 10	Subject matter and speaking style assessed in selecting infrastructures and architectural styles of the system as per cloud user and organizational requirements.	2
	PO 12	Keeping current in CSE and advanced engineering concepts in selecting infrastructures and architectural styles of the system as per cloud user and organizational requirements by tech talk, concept videos and open ended experiments.	1
	PSO 2	Focus on improving Network Security and IRS in selecting infrastructures and architectural styles of the system as per cloud user and organizational requirements.	2
	PSO 3	Make use of modern computer tools in selecting infrastructures and architectural styles of the system as per cloud user and organizational requirements.	1
CO 3	PO 1	Understand scientific principles and methodologies, other engineering disciplines in developing virtual machines to run different applications on different OSs.	2
	PO 2	Problem Analysis in developing virtual machines to run different applications on different OSs.	5
	PO 3	Design solutions for development of virtual machines to run different applications on different operating systems concurrently.	8
	PO 10	Subject matter and speaking style assessed in developing virtual machines to run different applications on different OSs.	2
	PO 12	Keeping current in CSE and advanced engineering concepts of advanced topics on virtual machines by tech talk, concept videos and open ended experiments.	1
	PSO 2	Focus on improving Network Security and IRS in developing virtual machines to run different applications on different OSs.	2
CO 4	PO 1	Apply scientific principles and methodology, mathematical principles and, other engineering disciplines on different types of resource scheduling algorithms for efficient utilization of pool of resources.	3
	PO 2	Problem Analysis in selecting different types of resource scheduling algorithms for efficient utilization of pool of resources.	8

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	PO 3 Design solutions for resource scheduling and management methods to find the best match of combined resources as per user requirement.	8
	PO 10	Subject matter and speaking style assessed in explanation of resource scheduling algorithms for efficient utilization of pool of resources.	2
	PO 12	Keeping current in CSE and advanced engineering concepts of advanced topics on efficient utilization of pool of resources by tech talk, concept videos and open ended experiments	1
	PSO 1	Understand, Design and Analyze Computer Programs used in resource scheduling for efficient utilization of pool of resources.	6
	PSO 2	Focus on improving Network Security and in selecting different types of resource scheduling for efficient utilization of pool of resources.	1
	PSO 3	Make use of modern computer tools in selecting different types of resource scheduling algorithms for efficient utilization of pool of resources.	1
CO 5	PO 1	Understand scientific principles and methodologies, other engineering disciplines to handle security and vulnerabilities for reducing system-specific attacks.	2
	PO 10	Subject matter and speaking style assessed in explanation of security and vulnerabilities in virtualization environment	2
	PO 12	Keeping current in CSE and advanced engineering concepts of advanced topics on security and vulnerabilities by tech talk, concept videos and open ended experiments	1
	PSO 2	Focus on improving Network Security and IRS in handling security and vulnerabilities for reducing system-specific attacks.	1
CO 6	PO 1	Analyze scientific principles and methodology, mathematical principles and, other engineering disciplines to use various cloud services and programming models to develop business model based on customer requirements	3
	PO 2	Problem Analysis in various cloud services and programming models to develop business model based on customer requirements	10
	PO 3	Design solutions for various cloud services and programming models by Defining and understanding cloud user and organizational requirements, identifying various cloud infrastructure and services, managing design process and evaluate the outcomes.	9
	PO 5	Usage of Cloud Management tool for modeling simple to complex engineering activities with understanding cloud user requirements and limitations.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	Subject matter and speaking style assessed in explanation of various cloud services and programming models to develop business model based on customer requirements	2
	PO 12	Keeping current in CSE and advanced engineering concepts of advanced topics on various cloud services and programming models by tech talk, concept videos and open ended experiments	4
	PSO 1	Understand, Design and Analyze Computer Programs used in various cloud services and programming models to develop business model based on customer requirements	6
	PSO 2	Focus on improving Network Security and IRS in various cloud services and programming models to develop business model based on customer requirements	2
	PSO 3	Make use of modern computer tools for various cloud services and programming models to develop business model based on customer requirements	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	7	-	-	-	-	-	-	-	2	-	1	-	-	1
CO 2	2	9	8	-	-	-	-	-	-	2	-	1	-	2	1
CO 3	2	5	4	-	-	-	-	-	-	2	-	1	-	2	-
CO 4	3	8	5	-		-	-	-	-	2	-	1	6	1	1
CO 5	2	-	-	-	-	-	-	-	-	2	-	1	-	1	-
CO 6	3	10	9	-	1	-	-	-	-	2	-	1	6	2	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.6	70.0	-	-	-	-	-	-	-	40.0	-	12.5	-		50.0
CO 2	66.6	90.0	80.0	-	-	-	-	-	-	40.0	-	12.5	-	100	50.0
CO 3	66.6	50.0	40.0	-	-	-	-	-	-	40.0	-	12.5	-	100	-
CO 4	100	80.0	50.0	-	-	-	-	-	-	40.0	-	12.5	100	50.0	50.0
CO 5	66.6	-	-	-	-	-	-	-	-	40.0	-	12.5	-	50.0	-
CO 6	100	100	90.0	-	100	-	-	-	-	40.0	-	12.5	100	100	50

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 - $5 < C \leq 40\%$ – Low/ Slight
2 - $40\% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	-	-	-	-	-	-	-	2	-	1	-	-	2
CO 2	3	3	3	-	-	-	-	-	-	2	-	1	-	3	2
CO 3	3	2	2	-	-	-	-	-	-	2	-	1	-	3	-
CO 4	3	3	2	-	-	-	-	-	-	2		1	3	2	2
CO 5	3	-	-	-	-	-	-	-	-	2	-	1	-	2	-
CO 6	3	3	3	-	3	-	-	-	-	2	-	1	3	3	2
TOTAL	18	14	10	-	3	-	-	-	-	12	-	6	6	15	8
AVERAGE	3.0	2.8	2.5	-	3.0	-	-	-	-	2.0	-	1	3	2.6	2

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION AND CLOUD APPLICATION DEVELOPMENT**
	Introduction: Definition, Characteristics, Benefits, challenges of cloud computing, cloud models: IaaS (infrastructure as service),PaaS(platform as a service),SaaS(software as a service), deployment models-public, private, hybrid, community; Types of cloud computing: Grid computing utility computing, cluster; computing Cloud services: Amazon, Google, Azure, online services, open source private clouds, SLA; Applications of cloud computing: Healthcare, energy systems, transportation, manufacturing, education, government, mobile communication, application development.

MODULE II	**CLOUD ARCHITECTURE, PROGRAMMING MODEL**
	Cloud Architecture, programming model: NIST reference architecture, architectural styles of cloud applications, single, multi, hybrid cloud site, redundant, non redundant, 3 tier, multi tier architectures; Programming model: Compute and data intensive.
MODULE III	**CLOUD RESOURCE VIRTUALIZATION**
	Cloud resource virtualization: Basics of virtualization, types of virtualization techniques, merits and demerits of Virtualization. Full vs Para - virtualization, virtual machine monitor/hypervisor; Virtual machine basics, taxonomy of virtual machines, process vs system virtual machines.
MODULE IV	**CLOUD RESOURCE MANAGEMENT AND SCHEDULING**
	Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, resource bundling, combinatorial , fair queuing, start time fair queuing, borrowed virtual time, cloud scheduling subject to deadlines, scheduling map reduce applications subject to deadlines, resource management and application scaling.
MODULE V	**CLOUD SECURITY**
	Cloud Security: Risks, privacy and privacy impacts assessments; Multi-tenancy issues, security in VM, OS, virtualization system security issues and vulnerabilities; Virtualization system-specific attacks: Technologies for virtualization-based security enhancement, legal.

TEXTBOOKS

1. Dan Marinescu, — Cloud Computing: Theory and Practice‖, M K Publishers, 1st Edition, 2013
2. Kai Hwang, Jack Dongarra, Geoffrey Fox, — Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖, M K Publishers, 1st Edition, 2011.

REFERENCE BOOKS:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, - Cloud Computing: A Practical Approach‖, McGraw Hill, 1st Edition, 2009.
2. Arshdeep Bahga, —Cloud Computing: A Hands on Approach‖, Vijay Madisetti Universities Publications, 1st Edition, 2013.

WEB REFERENCES:

1. https://www.oracle.com/in/cloud/application-development
2. http://computingcareers.acm.org/?page_id=12
3. http://en.wikibooks.org/wiki/cloud application

COURSE WEB PAGE:

https://www.iare.ac.in/?q=courses/computer-science-and-engineering-autonomous/cloud-application-development

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Overview, Objectives , Course Outcomes and POs/PSOs		
CONTENT DELIVERY (THEORY)			
2	Cloud Computing definition, characteristics	CO 1, CO 6	T1: 1.1, 1.2
3	benefits, challenges	CO 1, CO 6	T1: 1.1, 1.2
4	Cloud computing models	CO 1, CO 6	T1: 1.2
5	Cloud computing deployment models	CO 1, CO 6	T1: 1.2
6	Types of cloud computing techniques	CO 1, CO 6	T1: 1.2
7	Different types of Cloud Service Providers	CO 1, CO 6	T1: 1.3
8	Different types of Cloud Service Providers	CO 1, CO 6	T1: 1.3
9	Various applications of cloud computing	CO 1, CO 6	T1: 3.6
10	Cloud architecture concepts and selection criteria	CO 2, CO 6	T1: 1.1
11	Cloud architecture selection criteria	CO 2, CO 6	T1: 1.1
12	NIST reference architecture of cloud applications	CO 2, CO 6	T1: 1.1, 3.8
13	NIST reference architectural styles of cloud applications	CO 2, CO 6	T1: 1.1, 3.8
14	Programming model and Compute intensive model	CO 2, CO 6	T1: 4.2,4.3
15	Virtualization and types of virtualization techniques	CO 3	R2: 4.7
16	Merits and demerits of virtualization ; Full vs Para-virtualization	CO 3	T1: 4.9
17	Full vs Para-virtualization	CO 3	T1: 4.9
18	Virtual machine monitor/hypervisor and its types	CO 3	T1: 4.9
19	Cloud resource management and scheduling	CO 4	T1: 6.1
20	Various policies and mechanisms for resource management	CO 4	T1: 6.1
21	Policies and mechanisms for resource bundling, combinatorial	CO 4	T1: 6.1
22	Fair queuing, start time fair queuing, borrowed virtual time	CO 4	T1: 6.9, 6.10, 6.11

23	Map reduce applications subject to deadlines	CO 4	T1: 6.13
24	Resource management and application scaling.	CO 4	R1: 6.14
25	Cloud Security: Risks, privacy	CO 5	T1 : 9
26	Privacy impacts assessments	CO 5	T1: 9.5
27	Multi-tenancy issues	CO 5	T1: 9.5
28	Security in VM, OS	CO 5	R2: 9.6
29	Virtualization system security issues	CO 5	T1: 9.1
30	Virtualization system security vulnerabilities	CO 5	T1: 9.1
31	Virtualization system-specific attacks	CO 5	R1: 9.9
32	Technologies for virtualization-based security enhancement legal	CO 5	R1: 9.9
33	Reduce Risk and Confidently Accelerate your Business in the Cloud	CO 5	R1: 9.9
34	Prevent Threats In Without Impacting Your Cloud's Efficiency	CO 5	R1: 9.9
35	Empower Your Cloud Defense	CO 5	R1: 9.9
36	Market-Leading Protection	CO 5	R1: 9.9
37	Simplicity and Efficiency	CO 5	R1: 9.9
38	Best Runtime Protection	CO 5	R1: 9.9
39	Learn in-demand cloud computing skills and additionally prepare for Azure certification	CO 5	R1: 9.9
40	Clients design and realize the future of their business	CO 5	R1: 9.9
41	Virtualization system-specific attacks	CO 5	R1: 9.9
42	Technologies for virtualization-based security enhancement	CO 5	R1: 9.9
43	Virtualization system security	CO 5	R1: 9.9
44	Types of virtualization techniques	CO 5	R1: 9.9
45	Process vs system virtual machines	CO 5	R1: 9.9
PROBLEM SOLVING/ CASE STUDIES			
1	Cloud computing delivery models with security and the reliability of each model. Peer-to-peer systems and clouds the in terms of architecture, resource management, scope, and security	CO 1, CO 2	T1:3.6
2	Is cloud elasticity based on over provisioning sustainable? Give arguments to support. Debating whether to install a private cloud or to use a public cloud (e.g., the AWS) for its computational and storage needs for an organization.	CO 1, CO 2	T1:3.6
3	Mobile devices could benefit from cloud computing; explain the reasons.	CO 1, CO 2	T1:3.6
4	Tips for managing multi-cloud environment with real time example. Deploying a multi-tenant application across multiple cloud platforms.	CO 2, CO 6	T1:4.3

5	Usage of apache zookeeper to build distributed apps and describe how Zookeeper works. Case study on Hadoop distributed file system used in cloud Computing. Solving redundancy problems using different architectural styles	CO 2, CO 6	T1:4.3
6	Create a Map Reduce Application model by using data intensive model. Compare the latest Top 500 list with the Top 500 Green List of HPC systems based on publicly reported data.	CO 2, CO 6	T1:4.3
7	Discuss Virtualization Middleware for Scientific Cloud Computing in Open Source Offerings. Identify a hybrid cloud allows a company to maintain critical, confidential data and money on the new resources. Design a large-scale virtual cluster system	CO 3	T1:4.9, R2:4.7
8	VMs practically share all resources of the virtual infrastructure including virtual switch. Using Virtualization analyze memory virtualization, processor virtualization, and virtualization of a communication channel. Analyze the results of the performance comparison by using virtual machines.	CO 3	T1:4.9, R2:4.7
9	Virtualization of the processor combined with virtual Memory management poses multiple challenges. Describe the approaches used to exchange data among the domains of Xen and design experiments to compare the performance of data communication between the domains.	CO 3	T1:4.9, R2:4.7
10	Implementation of resource management policies: control theory, machine learning, utility-based, and market-oriented. Optimal strategies for one could be in conflict with optimal strategies for one or more of the other classes.	CO 4	T1:6.1, R1:6.14
11	Relationship between the scale of a system and the policies and the mechanisms for resource management. Workflow of cloud application use XML to describe this workflow, including the instances and the storage required for each task.	CO 4	T1:6.1, R1:6.14
12	Set up Hadoop-YARN cluster with ports to start each worker. Itanium architecture , and identify several possible reasons.	CO 4	T1:6.1, R1:6.14
13	Identify the main security threats for the SaaS cloud delivery model on a Public cloud. Analyze Amazon's privacy policies and design a service-level agreement. Cloud service to analyze images and sign them before being listed and made available to the general public.	CO 5	T1:9.1, R1:9.9

14	Analyze the implications of the two-level security model of commodity operating systems. Virtualization security on public, private, and hybrid clouds. Security risk posed by XenStore?	CO 5	T1:9.1, R1:9.9
15	Six attack surfaces are illustrated cloud delivery models. Impact of international agreements regarding privacy laws on cloud computing. Security and functionality in a hypervisor" and discuss the performance of the system. Virtual machine security and its application with an real time example by considering any one cloud service provider.	CO 5	T1:9.1, R1:9.9
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Definition, characteristics, benefits, challenges of cloud computing, cloud models, deployment models, types of cloud computing, cloud service provider, applications of cloud computing.	CO 1, CO 6	T1:3.6
2	Cloud architecture, architectural styles, programming models.	CO 2, CO 6	T1:4.3
3	Basics of virtualization, types of virtualization techniques, merits and demerits of virtualization, virtual machine basics, taxonomy of virtual machines, process vs system virtual machines.	CO 3	T1:4.9, R1:4.7
4	Policies and mechanisms for resource management, resource bundling, combinatorial , fair queuing, start time fair queuing, borrowed virtual time.	CO 4	T1:6.1, R1:6.14
5	Multi-tenancy issues, security in VM, OS, virtualization system security issues and vulnerabilities, technologies for virtualization.	CO 5	T1:9.1, R1:9.9
DISCUSSION OF QUESTION BANK			
1	Challenges of cloud computing ,Cloud services and Applications of cloud computing	CO 1, CO 6	R4:2.1
2	Cloud Architecture and programming model	CO 2, CO 6	T4:7.3
3	Cloud resource virtualization	CO 3	R4:5.1
4	Cloud Resource Management and Scheduling	CO 4	T1:7.5
5	Cloud Security	CO 5	T1: 4.1

Signature of Course Coordinator **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**
Course Title	**CYBER SECURITY**
Course Code	ACIC12
Program	B.Tech
Semester	VII
Course Type	Elective
Regulation	UG-20

<table>
<tr><td rowspan="3">Course Structure</td><td colspan="3">Theory</td><td colspan="2">Practical</td></tr>
<tr><td>Lecture</td><td>Tutorials</td><td>Credits</td><td>Laboratory</td><td>Credits</td></tr>
<tr><td>3</td><td>-</td><td>3</td><td>-</td><td>-</td></tr>
<tr><td>Course Coordinator</td><td colspan="5">Ms. T Jayasri Devi , Assistant Professor</td></tr>
</table>

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITC06	V	Computer Networks

II COURSE OVERVIEW:

Cyber Security was designed to help learners develop a deeper understanding of modern informationand system protection technology and methods. The learning outcome is simple: We hope learners will develop a lifelong passion and appreciation for cyber security, which are certain will help in future endeavors. Students, developers, managers, engineers, and even private citizens will benefit from this learning experience. Special customized interviews with industry partners were included to help connect the cyber security concepts to live business experiences.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Cyber Security	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	x	Chalk & Talk	✓	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10 %	Remember
60 %	Understand
20 %	Apply
10 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

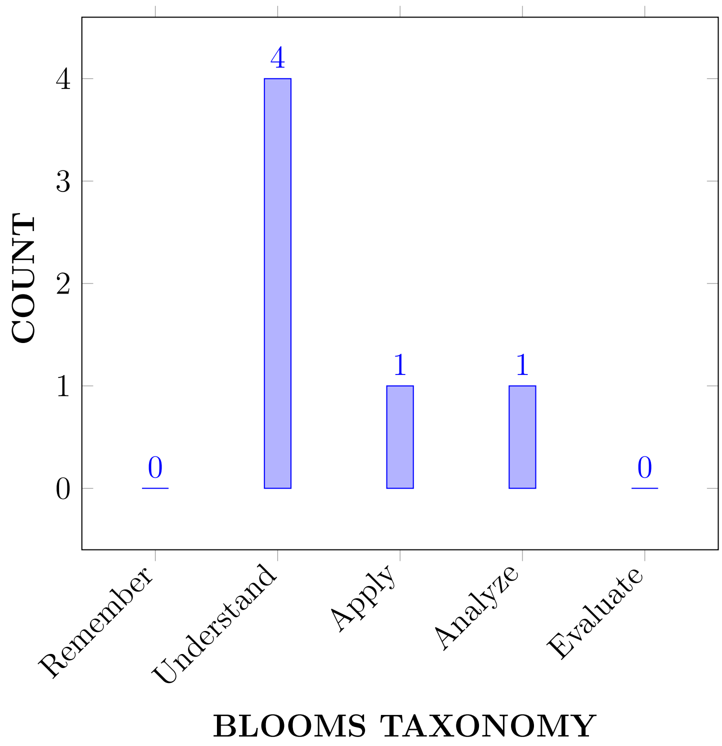
I	The broad set of technical, social and political aspects of computer security.
II	The key components of cyber security and the network architecture.
III	The threats and risks within context of the cyber security and also know the operational and organizational security aspects.
III	Different types of incidents including categories, responses and timelines for response.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Interpret** the various kinds of threats and attacks to protect a network	Understand
CO 2	**Demonstrate** the core components of operating system security and explore strategys for minimizing security risks in operating system.	Understand
CO 3	**Analyze** network security threats and application of counter measures to protect network,such as IPS,Firewall,	Analyze
CO 4	**Make use of** the security database requirements and design data base	Apply
CO 5	**Summarize** the privacy principles , policies and technologies for cyber space.	Understand
CO 6	**Explain** the security planning, riskAnalysis for management of various network security Applications	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE/Quiz/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	CIE/Quiz/AAT
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction analysis and interpretation of data,and synthesis of the information to provide valid conclusions and modeling to complex engineering activities with an understanding of the limitations.	2	CIE/Quiz/AAT
PO 10	**Communication:** Communicate effectively on complex Engineering activities with the Engineering .community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions..	2	CIE/Quiz/AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms,System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	2	SEE/AAT
PSO 2	Focus on improving software reliability, network security or information retrieval systems..	2	SEE/AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	✓	✓	-	-	-	-	-	✓	-		✓	-	✓
CO 2	✓	-	✓	-	-	-	-	-	-	-	-	-	✓	-	-
CO 3	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 4	✓	-	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 5	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 6	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	✓	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Apply the knowledge of mathematics, science, engineering **specialization to the solution of complex engineering problems.**	2
	PO 3	Design solutions for complex engineering problems **and design system components or processes that meet the specified** needs with appropriate **consideration for the public health and safety, and the cultural, societal,and environmental** considerations.	3
	PO 4	Use research-based knowledge and research methods including design of experiments,analysis and interpretation of data, and **synthesis of the information to provide valid conclusions. .**	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and **write effective reports and design documentation, make effective presentations, and give and receive clear instructions .**	2
	PSO1	Understand, design and analyze computer programs in the areas related to Algorithms, **System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.**	6
	PSO3	Make use of modern computer tools for creating innovative career paths, to be an **entrepreneur and desire for higher studies.**	2
CO 2	PO 1	Apply the knowledge of mathematics, science, engineering **specialization to the solution of complex engineering problems.**	2
	PO 3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the **public health and safety, and the cultural, societal, and environmental considerations**	2
	PSO1	Understand, design and analyze computer programs in the areas related to Algorithms, **System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.**	4
CO 3	PO 1	Apply the knowledge of mathematics, science, engineering **specialization to the solution of complex engineering problems.**	2
	PSO1	Understand, design and analyze computer programs in the areas related to Algorithms, **System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.**	4
CO 4	PO 1	Apply the knowledge of mathematics, science, engineering **specialization to the solution of complex engineering problems.**	2
	PO 3	Design solutions for complex engineering problems **and design system components or processes that meet the specified** needs with appropriate **consideration for the public health and safety, and the cultural, societal,and environmental** considerations.	3
	PO 5	Create, select, and apply appropriate techniques, resources, and modern engineering and. **IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations**	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write **effective reports and design documentation, make effective presentations, and give and receive clear instructions..**	1
	PO 12	Recognize the need for advanced concepts related to HTML and CSS for understanding and developingweb applications through continuing education efforts with and **ongoing learning – stays up with industry trends.**	1
	PSO1	Understand, design and analyze computer programs in the areas related to Algorithms, **System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.**	6
	PSO 2	Focus on improving software reliability, **network security or information retrieval systems.**	2
	PSO3	Make use of modern computer tools for creating innovative career paths, to be an **entrepreneur and desire for higher studies.**	2
CO 5	PO 1	Apply the knowledge of mathematics, science, engineering **fundamentals, and an engineering specialization to the solution of complex engineering problems..**	2
	PO 2	Identify, formulate, review research literature, and analyze complex engineering **problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering science**	2
	PO 3	Design solutions for complex engineering problemsand design system components or processes that meet the specified needs with appropriate. **consideration for the public health and safety, and the cultural, societal, and environmental considerations**	2
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and**write effective reports and design documentation, make effective presentations, and give and receive clear instructions..**	2
	PO 12	Recognize the need for, and have the preparation and ability to engage in independent and **life-long learning in the broadest context of technological change**	2
	PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, **Web design, Big data, Artificial Intelligence, Machine Learning and Networking**	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 2	Focus on improving software reliability, network security or **.information retrieval systems**	2
	PSO 3	Make use of modern computer tools for **creating innovative career paths, to be an entrepreneur and desire for higher studies** and	2
CO 6	PO 1	Apply the knowledge of mathematics, science, engineering fundamentals, and **an engineering specialization to the solution of complex engineering problems.**	2
	PO 5	Create, select, and apply appropriate techniques, resources, and **IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.**	1
	PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software,**Web design, Big data, Artificial Intelligence, Machine Learning and Networking**	2
	PSO 2	**Focus on improving software reliability,** network security or information retrieval systems.	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	3	2	-	-	-	-	-	2	-		6	-	2
CO 2	2	-	2	-	-	-	-	-	-	-	-	-	4	-	-
CO 3	2	-	-	-	-	-	-	-	-		-	-	4	-	-
CO 4	2	-	3	-	1	-	-	-	-	1	-	1	6	2	2
CO 5	2	2	2	-	-	-	-	-	-	2	-	2	2	2	2
CO 6	2	-	-	-	1	-	-	-	-	-	-	-	2	2	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.6	0.0	30.0	18.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	100	0.0	0.0
CO 2	66.6	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.6	0.0	0.0
CO 3	66.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.6	0.0	0.0
CO 4	66.6	0.0	30.0	0.0	100	0.0	0.0	0.0	0.0	20.0	0.0	12.5	100	100	100
CO 5	66.6	66.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	25.0	33.0	100	100
CO 6	66.6	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	80.0	0.0	0.0	100	100	100

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	1	1	-	-	-	-	-	1	-	-	3	-	-
CO 2	3	-	1	-	-	-	-	-	-	-	-	-	3	-	-
CO 3	3	-	1	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	3	-	1	-	3	-	-	-	-	1	-	1	3	3	3
CO 5	3	3	1	-	-	-	-	-	-	2	-	1	1	3	3
CO 6	3	3	1	-	3	-	-	-	-	2	-	1	1	3	3
TOTAL	18	6	6	1	6	-	-	-	-	6	-	3	14	9	9
AVERAGE	3	1.5	1.0	0.1	1	-	-	-	-	1	-	2.0	2.3	1.5	2.3

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	-	Open Ended Experiments	✓
Assignments	✓				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

X	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO CYBER SECURITY(09)**
	Introduction, Computer Security , Threats , Harm , Vulnerabilities , Controls, Authentication , Access Control and Cryptography , Web user side , Browser attacks , Web attacks targeting users , Obtaining user or website data , Email attacks
MODULE II	**SECURITY IN OPERATING SYSTEM AND NETWORKS (09)**
	Security in Operating Systems, Security in the Design of Operating Systems, Rootkit, Network security attack, Threats to Network Communications, Wireless Network, Security, Denial of Service, Distributed Denial-of-Service.

MODULE III	**DEFENCES: SECURITY COUNTER MEASURES (09)**
	Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management.Databases, Security Requirements of Databases, Reliability and Integrity, Database Disclosure, Data Mining and Big Data.
MODULE IV	**PRIVACY IN CYBERSPACE (09)**
	Privacy Concepts, Privacy principles and policies, Authentication and privacy, data mining, privacy on the web, Email security, Privacy impacts of emerging technologies where the field is headed.
MODULE V	**MANAGEMENT AND INCIDENTS (09)**
	Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster, Emerging Technologies, The Internet of Things, Economics, Electronic Voting, Cyber Warfare, Cyberspace and the Law, International Laws, Cyber-crime, Cyber Warfare and Home Land Security

TEXTBOOKS

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, "Security in Computing", 5th Edition, Pearson Education, 2015.

2. MarttiLehto, PekkaNeittaanmäki, "Cyber Security: Analytics, Technology and Automation", Springer International Publishing Switzerland 2015.

REFERENCE BOOKS:

1. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

2. George K. Kostopoulous, "Cyber Space and Cyber Security", CRC Press, 2013.

WEB REFERENCES:

1. https://towardsdatascience.com/tagged/cybersecurity

2. https://towardsdatascience.com/tagged/information-security

3. https://medium.com/codex/data-science-for-cyber-security-32e2f81e15d3

4. https://www.infosecinstitute.com/skills/learning-paths/cybersecurity-data-science/

COURSE WEB PAGE:

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
1	Introducation to cyber security	CO1	T1: 1.1
2	Introduction, Computer Security	CO1	T1:1.2
3	Threats	CO1	T1: 1.3
4	Harm	CO1	T1:1.4
5	Vulnerabilities	CO1	T1: 1.5
6	Controls	CO1	T1:7.1
7	Authentication	CO1	T1: 2.14
8	Access Control and Cryptography	CO1	T1: 8.1
9	Web user side	CO1	T1: 8.2
10	Browser attacks	CO1	T1: 10.0
11	Web attacks targeting users	CO1	T1: 10.1
12	Obtaining user or website data	CO1	T1: 10.1
13	Email attacks	CO1	T1: 10.2
14	Security in operating system and networks	CO1	T1: 10.2
15	Security in Operating Systems	CO2	T1: 11.1
16	Security in the Design of Operating Systems	CO2	T1: 11.2
17	Rootkit	CO2	T1: 11.3
18	Network security attack	CO2	T1:15.3
19	Threats to Network Communications	CO3	T1:19.1
20	Wireless Network	CO3	T1: T1:19.1
21	Security	CO3	T1:19.1
22	Denial of Service	CO3	T1:19.1
23	Distributed Denial-of-Service	CO3	T1:19.1
24	Defences:Security counter measures	CO3	T1:19.2
25	Cryptography in Network Security	CO3	T1:19.2
26	Firewalls	CO4	T1:19.1
27	Intrusion Detection and Prevention Systems	CO4	T1:23.0
28	Network Management	CO4	T1:23.1
29	Databases, Security Requirements of Databases	CO4	T1:23.1
30	Reliability and Integrity	CO4	T1:23.2
31	Database Disclosure, Data Mining and Big Data	CO4	T1:23.3
32	Privacy in cyberspace,Privacy Concepts, Privacy principles and policies	CO5	T1:23.3

33	Authentication and privacy, data mining, privacy on the web, Email security	CO5	T1:23.3
34	Privacy impacts of emerging technologies where the field is headed	CO5	T1:25.1
35	Management and Incidents Security Planning, Business Continuity Planning	CO6	T1:25.2
36	Handling Incidents, Risk Analysis, Dealing with Disaster, Emerging Technologies	CO6	T1:25.3
37	The Internet of Things, Economics, Electronic Voting, Cyber Warfare	CO6	T1:25.4
38	Cyberspace and the Law	CO6	T1:25.5
39	International Laws, Cyber-crime	CO6	T1:25.6
40	Cyber Warfare and Home Land Security.	CO6	T1:25.7
PROBLEM SOLVING/ CASE STUDIES			
41	Stuxnet Worm (2010): Stuxnet was a highly sophisticated computer worm discovered in 2010. It is widely believed to be a joint effort by the United States and Israel with the aim of disrupting Iran's nuclear program. Stuxnet targeted industrial control systems	CO 1	T2:18.3.4, 18.3, 4.17
42	Phishing Attack: Case Study - "Google and Facebook Phishing Attack (2021)": In 2021, a sophisticated phishing campaign targeted employees of major tech companies, including Google and Facebook. The attackers sent convincing emails disguised as internal company communications,	CO2 CO3	T2:24.2,28.4
43	Android Permissions Model (Ongoing Issue): The Android operating system, due to its open nature and diverse ecosystem, has faced challenges with security in its design. The permissions model for Android apps has been a topic of concern	CO 4	T1: 276-296
44	General Data Protection Regulation (GDPR) Implementation (2018): The General Data Protection Regulation (GDPR) is a comprehensive data privacy regulation that came into effect in the European Union in 2018. It sets out various privacy principles, such as data minimization	CO 5	T2:24.3.6, 24.3.9
45	Apple Face ID and Biometric Authentication: Apple's Face ID is a biometric authentication feature introduced in their iPhones. It uses facial recognition technology to authenticate users and unlock their devices securely. While biometric authentication offers convenience and improved security	CO 6	T2:25.1, 25.1.2
46	Aadhaar Biometric System (India): Aadhaar is a biometric authentication system implemented by the Government of India. It aims to provide a unique identity to each Indian resident based on their biometric and demographic information.	CO 6	T2:26.1.2, 26.2, 26.3, 26.4,26.5
DEFINITION AND TERMINOLOGY			
1	Computer Security , Threats , Harm , Vulnerabilities , Controls?	CO 1	T2:2.1

2	Wireless Network, Security, Denial of Service, Distributed ?	CO2 CO3	T2:2.3
3	Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems?	CO4	T2:2.3.1
4	Privacy Concepts, Privacy principles and policies, Authentication and privacy, data mining,.	CO 5	T2:7.2,7.3
5	Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis,	CO 6	T2:10.3.1
DISCUSSION OF QUESTION BANK			
1	Introduction to cyber security.	CO 1	T2:2.1
2	Security in operating system and networks	CO2 CO3	T2:2.3
3	Defences:security counter measures	CO 4	T2:2.3.1
4	Privacy in cyberspace	CO 5	T2:7.2,7.3
5	Management and incidents	CO 6	T2:10.3.1
6	Security Planning, Business Continuity Planning, Handling Incidents	CO 6	T2:13.3.2, 13.4.1

Signature of Course Coordinator **HOD,CSE**
Ms. T Jayasri Devi, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**Computer Science and Engineering**				
Course Title	**Embedded Systems**				
Course Code	AECC40				
Program	B. Tech				
Semester	VII				
Course Type	Open Elective-II				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Mr. B. Brahmaiah, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
B.Tech	ACSC07	III	Computer Organization and Architecture	3
B.Tech	ACSC12	IV	Operating Systems	3

II COURSE OVERVIEW:

This course allows students to learn the fundamentals of embedded system hardware and firmware design. It focusses on embedded system design process, embedded C, interfacing modules, software development tools for debugging and testing of embedded applications, ARM and SHARC processor architectures and memory organization. It provides hands-on experience on implementation of embedded application prototype design using embedded C.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Embedded Systems	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
66.6%	Understand
16.6 %	Apply
16.6 %	Analyze
0%	Evaluate
0%	Create

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Videos	Tech-talk	Open Ended Experiment
50%	50%	-

VI COURSE OBJECTIVES:

The students will try to learn:

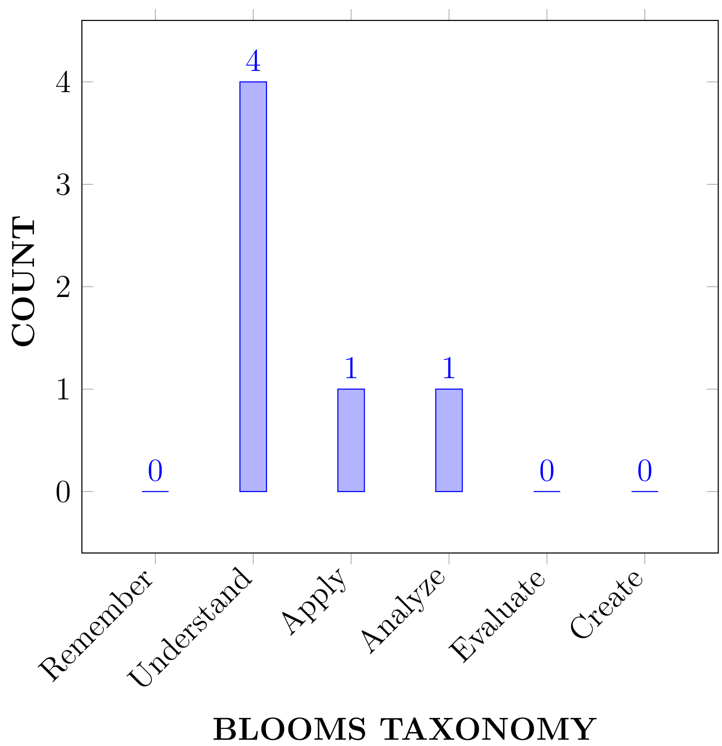
I	The concepts of embedded computing, embedded C, RTOS and embedded software tools for implementing embedded systems.
II	Embedded software development tools for debugging and testing of embedded applications, architectures of ARM and SHARC processors.
III	Interfacing with external environments using sensors, actuators and communication in distributed embedded systems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Summarize** the concepts of Embedded Systems and formalisms for system design with examples.	Understand
CO 2	**Examine** and write the Embedded Systems programming in C with Keil Integrated Development Environment (IDE).	Analyze
CO 3	**Demonstrate** the principles of RTOS and the methods used for saving memory and power in real time environments.	Understand
CO 4	**Make use of** embedded software development tools for debugging and testing of embedded applications.	Apply
CO 5	**Illustrate** the architecture, memory organization and instruction level parallelism of ARM and SHARC processors used in Embedded Systems.	Understand
CO 6	**Interpret** the concepts of Internet of Things used in the embedded systems applications.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE/CIE/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	SEE/CIE/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	SEE/CIE/AAT
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	SEE/CIE/AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	SEE/CIE/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data,**Artificial Intelligence, Machine Learning** and Networking.	1	AAT / Projects

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 2	✓	✓	✓	-	✓	-	-	-	-	✓	-	-	-	-	-
CO 3	✓	-	-	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 4	✓	✓	✓	-	✓	-	-	-	-	✓	-	-	-	-	-
CO 5	✓	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 6	✓	✓	✓	-	-	-	-	-	-	✓	-	-	-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO1	PO 1	Illustrate the concepts (knowledge) of embedded systems using their architectures by using **mathematics, science, engineering fundamentals** to the solution of complex engineering problems.	3
	PO 10	Describe the concepts of Embedded Systems and formalisms by **giving effective presentations and take clear instructions** for system design with examples.	1
	PSO1	Understand, design and analyze computer programs in the areas related to **develop data centric applications using the concepts of System Software, Artificial Intelligence, Machine Learning and Networking.**	1
CO2	PO 1	Apply the integration of sensors, actuators and on-chip peripherals of microcontroller architectures for prototype design by applying **science** and **engineering fundamentals**.	2
	PO 2	Understand the given embedded application **problem statement** and finding the solution implementation and select proper language for **information and data collection** for **solution development** by writing embedded C language programming efficient and **interpretation of results**.The prototype embedded system design by analyzing complex engineering problems.	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	**Manage the design process** and make **use of creativity to establish solutions** by selecting proper syntaxes to write the embedded C language programming by **understanding of the requirement for engineering activities to promote sustainable development** and design solutions for complex Engineering problems and design system components of embedded applications that meet the specified needs with appropriate consideration for the public **health and safety, and the cultural, societal, and Environmental considerations.**	4
CO2	PO 5	Select and apply appropriate techniques of **(Modern Tool Usage)** Keil Integrated Development Environment, for design of the basic embedded modules using different electronic circuits to provide valid conclusions.	1
	PO 10	Use Keil Integrated Development Environment by **giving effective presentations and take clear instructions** for analyzing the Embedded Systems programming in C.	1
CO3	PO 1	Demonstrate (knowledge) the principles of RTOS such as interrupt latency and context switching in hard real time environments by applying the knowledge of **mathematical model, science and engineering fundamentals**	3
	PO 10	Describe the principles of RTOS and the methods used for saving memory and power with Keil Integrated Development Environment by **giving effective presentations and take clear instructions** in real time environments.	1
	PSO1	Understand, design and analyze computer programs in the areas related to **develop data centric applications using the concepts of System Software, Artificial Intelligence, Machine Learning and Networking.**	1
CO4	PO 1	Make use of embedded software development tools (knowledge) for debugging and testing of embedded applications to the solution of complex engineering problems using **mathematics, science, engineering fundamentals**.	3
	PO 2	**Identify the problem** and understand the given embedded application and choose necessary hardware and software interface for **information and data collection** and **conduct experimental design** and **finding the solution implementation** of embedded applications using development tools by analyzing complex engineering problems.	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	**Understand the customer and user needs** and select an appropriate RTOS and Software development tools by **managing the design process and evaluate outcomes** to **promote sustainable development** for data transfer between the devices using **creativity to establish innovative solutions**.	4
	PO 5	Create, select, and apply appropriate techniques, resources, and modern Engineering tools including prediction and modelling the embedded circuits using **Keil integrated development environment tool** to complex Engineering activities with an understanding of the limitations.	1
CO4	PO 10	Use embedded software development tools by **giving effective presentations and take clear instructions** for debugging and testing of embedded applications.	1
CO5	PO 1	Understand (knowledge) the architecture, memory management and application development using ARM and SHARC processors by applying **science and engineering fundamentals**.	2
	PO 10	Explain the architecture, memory organization and instruction level parallelism of ARM and SHARC processors by **giving effective presentations and taking clear instructions**.	1
CO6	PO 1	Model a embedded application prototype using embedded C by applying **engineering fundamentals**.	1
	PO 2	Understand the **problem statement** and **solve** embedded **prototype implementation** using the concepts of Internet Of Things **(information and data collection)** and **interpret the results** in global engineering applications in complex problem analysis using mathematics.	5
	PO 3	**Using creativity to establish innovative solutions** and **understanding of the requirement for engineering activities to promote sustainable development** for design a complex engineering problems and real time processes that meet the specified needs with appropriate consideration for the **public health and environmental considerations**.	3
	PO 10	Interpret the concepts of Internet of Things used in embedded systems applications by **giving effective presentations and taking clear instructions**.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	8	6	2	2
CO 1	3	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO 2	2	4	4	-	1	-	-	-	-	1	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO 4	3	4	4	-	1	-	-	-	-	1	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO 6	1	5	3	-	-	-	-	-	-	1	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	20	-	-	16.6	-	-
CO 2	66.6	40	40	-	100	-	-	-	-	20	-	-	-	-	-
CO 3	100	-	-	-	-	-	-	-	-	20	-	-	16.6	-	-
CO 4	100	40	40	-	100	-	-	-	-	20	-	-	-	-	-
CO 5	66.6	-	-	-	-	-	-	-	-	20	-	-	-	-	-
CO 6	33.3	50	30	-	-	-	-	-	-	20	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -5 $< C \leq 40\%$ – Low/ Slight
2 - 40 % $< C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO 2	3	1	1	-	3	-	-	-	-	1	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO 4	3	1	1	-	3	-	-	-	-	1	-	-	-	-	-
CO 5	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO 6	1	2	1	-	-	-	-	-	-	1	-	-	-	-	-
TOTAL	16	4	3	-	6	-	-	-	-	6	-	-	2	-	-
AVERAGE	2.66	1.33	1	-	3	-	-	-	-	1	-	-	1	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	AAT	✓
Quiz	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	-	Open Ended Experiments	-
Seminars	-	Laboratory Practices	-		

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of activities / Modeling and Experimental Tools in Engineering by Experts		

XVIII SYLLABUS:

MODULE I	**EMBEDDED COMPUTING**
	Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, complex systems and microprocessor, classification, major application areas, the embedded system design process, characteristics and quality attributes of embedded systems, formalisms for system design, design examples.
MODULE II	**INTRODUCTION TO EMBEDDED C AND APPLICATIONS**
	C looping structures, register allocation, function calls, pointer aliasing, structure arrangement, bit fields, unaligned data and endianness, inline functions and inline assembly, portability issues; Embedded systems programming in C, binding and running embedded C program in Keil IDE, dissecting the program, building the hardware; Basic techniques for reading and writing from I/O port pins, switch bounce; Applications: Switch bounce, LED interfacing, interfacing with keyboards, displays, D/A and A/D conversions, multiple interrupts, serial data communication using embedded C interfacing.
MODULE III	**RTOS FUNDAMENTALS AND PROGRAMMING**
	Operating system basics, types of operating systems, tasks and task states, process and threads, multiprocessing and multitasking, how to choose an RTOS ,task scheduling, semaphores and queues, hard real-time scheduling considerations, saving memory and power. Task communication: Shared memory, message passing, remote procedure call and sockets; Task synchronization: Task communication synchronization issues, task synchronization techniques, device drivers.
MODULE IV	**EMBEDDED SOFTWARE DEVELOPMENT TOOLS**
	Host and target machines, linker/locators for embedded software, getting embedded software into the target system; Debugging techniques: Testing on host machine, using laboratory tools, an example system.
MODULE V	**INTRODUCTION TO ADVANCED PROCESSOR**
	Introduction to advanced architectures: ARM and SHARC, processor and memory organization and instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-Enabled systems, design example-Elevator controller.

TEXT BOOKS

1. Shibu K.V, “Introduction to Embedded Systems”, Tata McGraw Hill Education Private Limited, 2nd Edition, 2009.
2. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, Tata McGraw-Hill Education, 2nd Edition, 2011.
3. Andrew Sloss, Dominic Symes, Wright, “ARM System Developer’s Guide Designing and Optimizing System Software”, 1st Edition, 2004.

REFERENCE BOOKS:

1. Wayne Wolf, — Computers as Components, Principles of Embedded Computing Systems Design, Elsevier, 2 nd Edition, 2009
2. Dr. K. V. K. K. Prasad, — Embedded / Real-Time Systems: Concepts, Design & Programming, dreamtech publishers, 1 st Edition, 2003.
3. Frank Vahid, Tony Givargis, —Embedded System Design‖, John Wiley & Sons, 3 rd Edition, 2006
4. Lyla B Das, “Embedded Systems” , Pearson Education, 1st Edition, 2012.
5. David E. Simon, “An Embedded Software Primer”, Addison-Wesley, 1st Edition, 1999.
6. Michael J.Pont, “Embedded C”, Pearson Education, 2nd Edition, 2008.

WEB REFERENCES:

1. https://www.smartzworld.com/notes/embedded-systems-es/
2. http://notes.specworld.in/embedded-systems-es/
3. http://education.uandistar.net/jntu-study-materials
4. http://www.nptelvideos.in/2012/11/embedded-systems.html

COURSE WEB PAGE:

1. https://lms.iare.ac.in/index?route=course/playercourseid = 228sectionid = 729lessonid = 7135

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	https://lms.iare.ac.in/index?route=course/details&courseid=228
CONTENT DELIVERY (THEORY)			
2	Definition of embedded system, embedded systems vs. general computing systems.	CO 1	T1-1.1
3	History of Embedded systems	CO 1	T1-1.
4	Complex systems and microprocessor, classification,major application areas.	CO 1	T1-1.3
5	The embedded system design process	CO 1	T2-1.4
6	Characteristics and quality attributes of embedded systems	CO 1	T2-1.5
7	Formalisms for system design, design examples.	CO1	R2-1.2
10	Introduction to embedded C,C looping structures.	CO 2	T3-1.3
11	Register allocation, Function calls, and pointer aliasing.	CO 2	T3-2.4
12	Structure arrangement, Bit fields, unaligned data and endianness.	CO 2	T3-2.5
13	Inline functions and inline assembly, portability issues.	CO 2	T3-2.6
14	Embedded systems programming in C, binding and running embedded C program in Keil IDE	CO 2	T3-2.7
15	Embedded C program in Keil IDE, dissecting the program, building the hardware	CO 2	T3-2.8
16	Basic techniques for reading and writing from I/O port pins, switch bounce	CO 2	T3-2.9
17	Applications: Switch bounce, LED interfacing.	CO 2	R2-3.1
18	Interfacing with keyboards, displays	CO 2	R2-3.2
19	D/A and A/D conversions, multiple interrupts.	CO 2	R2-3.3
20	Serial data communication using embedded C interfacing.	CO 2	R2-3.4
28	RTOS Fundamentals, Operating system basics, types of operating systems	CO 3	R2-3.5
29	Tasks and task states, process and threads	CO 3	R2-3.6
30	Multiprocessing and multitasking, how to choose an RTOS	CO 3	R3-3.7
31	Task scheduling, semaphores and queues	CO 3	R3-3.8
32	Hard real-time scheduling considerations, saving memory and power.	CO 3	R3-4.1

33	Task communication: Shared memory, message passing	CO 3	R3-4.1
34	Remote procedure call and sockets	CO 3	R3-4.2
35	Task synchronization: Task communication synchronization issues	CO 3	R3-4.2
36	Task synchronization techniques, device drivers.	CO 3	R3-4.3
37	Host and target machines	CO 4	R3-4.3
38	Linker for embedded software	CO 4	R3-4.4
39	Locators for embedded software	CO 4	R3-4.4
40	Getting embedded software into the target system	CO 4	R3-4.5
41	Debugging techniques: Testing on host machine	CO 4	R3-4.5
44	Debugging techniques using laboratory tools, an example system.	CO 4	R3-4.5
47	Introduction to advanced architectures: ARM	CO 5	T2-8.1
48	Introduction to advanced architectures: SHARC	CO 5	T2-8.1
49	Processor and memory organization	CO 5	T2-8.2
50	Instruction level parallelism	CO 5	T2-8.2
51	Networked embedded systems: Bus protocols	CO 6	T2-8.3
52	Networked embedded systems: I2C bus and CAN bus	CO 6	T2-8.3
53	Internet-Enabled systems	CO 6	T2-8.4
54	Design example-Elevator controller.	CO 6	T2-8.4
PROBLEM SOLVING/ CASE STUDIES			
8	BMW 850i brake and stability control system	CO 1	T2-1.4
9	Design example of model train controller	CO 1	T3-2.7
21	Embedded C program for Switch bounce	CO 2	R2-3.2
22	Embedded C program for LED interface	CO 2	R3-4.5
23	Embedded C program for Interfacing with keyboards	CO 2	T2-8.2
24	Embedded C program for Interfacing with displays	CO 2	T2-1.4
25	Embedded C program for 7 Segment Display Interfacing	CO 2	T3-2.7
26	Embedded C program for ADC Interfacing with 8051 microcontroller	CO 2	R2-3.2
27	Embedded C program for DAC Interfacing with 8051 microcontroller	CO 2	R3-4.5
45	Design of Digital camera	CO 4	T2-8.2
46	Design of Microwave oven	CO 4	T2-1.4
55	Design of Elevator controller	CO 6	T3-2.7
DISCUSSION OF DEFINITION AND TERMINOLOGY			
56	Embedded computing	CO 1	T1-1.3
57	Introduction to embedded c and applications	CO 2	T3-2.4
58	RTOS fundamentals and programming	CO 3	R3-4.2
59	Embedded software development tools	CO 4	R3-4.4
60	Introduction to advanced processors	CO 5, CO 6	T2-8.3

DISCUSSION OF QUESTION BANK			
61	Embedded computing	CO 1	T1-1.3
62	Introduction to embedded c and applications	CO 2	T3-2.4
63	RTOS fundamentals and programming	CO 3	R3-4.2
64	Embedded software development tools	CO 4	R3-4.4
65	Introduction to advanced processors	CO 5, CO 6	T2-8.3

Course Coordinator **HOD,ECE**
Mr. B.Brahmaiah, Assistant Professor

ANNEXURE - I

KEY ATTRIBUTES FOR ASSESSING PROGRAM OUTCOMES

PO Number	NBA Statement / Key Competencies Features (KCF)	No. of KCF's
PO 1	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems **(Engineering Knowledge).** Knowledge, understanding and application of 1. Scientific principles and methodology. 2. Mathematical principles. 3. Own and / or other engineering disciplines to integrate / support study of their own engineering discipline.	3
PO 2	Identify, formulate, review research literature, and analyse complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences (**Problem Analysis).** 1. Problem or opportunity identification 2. Problem statement and system definition 3. Problem formulation and abstraction 4. Information and data collection 5. Model translation 6. Validation 7. Experimental design 8. Solution development or experimentation / Implementation 9. Interpretation of results 10. Documentation	**10**
PO 3	Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations (**Design/Development of Solutions).** 1. Investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues 2. Understand customer and user needs and the importance of considerations such as aesthetics 3. Identify and manage cost drivers 4. Use creativity to establish innovative solutions 5. Ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal 6. Manage the design process and evaluate outcomes. 7. Knowledge and understanding of commercial and economic context of engineering processes 8. Knowledge of management techniques which may be used to achieve engineering objectives within that context 9. Understanding of the requirement for engineering activities to promote sustainable development 10. Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	**10**

PO 4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions (**Conduct Investigations of Complex Problems).** 1. Knowledge of characteristics of particular materials, equipment, processes, or products 2. Workshop and laboratory skills 3. Understanding of contexts in which engineering knowledge can be applied (example, operations and management, technology development, etc.) 4. Understanding use of technical literature and other information sources Awareness of nature of intellectual property and contractual issues 5. Understanding of appropriate codes of practice and industry standards 6. Awareness of quality issues 7. Ability to work with technical uncertainty 8. Understanding of engineering principles and the ability to apply them to analyse key engineering processes 9. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modeling techniques 10. Ability to apply quantitative methods and computer software relevant to their engineering discipline, in order to solve engineering problems 11. Understanding of and ability to apply a systems approach to engineering problems.	**11**
PO 5	Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations **(Modern Tool Usage).** 1. Computer software / simulation packages / diagnostic equipment / technical library resources / literature search tools.	**1**
PO 6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice (**The Engineer and Society).** 1. Knowledge and understanding of commercial and economic context of engineering processes 2. Knowledge of management techniques which may be used to achieve engineering objectives within that context 3. Understanding of the requirement for engineering activities to promote sustainable development 4. Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues 5. Understanding of the need for a high level of professional and ethical conduct in engineering.	**5**

PO 7	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development (**Environment and Sustainability).** Impact of the professional Engineering solutions (Not technical) 1. Socio economic 2. Political 3. Environmental	**3**
PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice (**Ethics).** 1. Comprises four components: ability to make informed ethical choices, knowledge of professional codes of ethics, evaluates the ethical dimensions of professional practice, and demonstrates ethical behavior. 2. Stood up for what they believed in 3. High degree of trust and integrity	**3**
PO 9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings (**Individual and Teamwork).** 1. Independence 2. Maturity – requiring only the achievement of goals to drive their performance 3. Self-direction (take a vaguely defined problem and systematically work to resolution) 4. Teams are used during the classroom periods, in the hands-on labs, and in the design projects. 5. Some teams change for eight-week industry oriented Mini-Project, and for the seventeen -week design project.	**12**
	6. Instruction on effective teamwork and project management is provided along with an appropriate textbook for reference 7. Teamwork is important not only for helping the students know their classmates but also in completing assignments. 8. Students also are responsible for evaluating each other's performance, which is then reflected in the final grade. 9. Subjective evidence from senior students shows that the friendships and teamwork extends into the Junior years, and for some of those students, the friendships continue into the workplace after graduation 10. Ability to work with all levels of people in an organization 11. Ability to get along with others 12. Demonstrated ability to work well with a team	

PO 10	Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (**Communication).** "Students should demonstrate the ability to communicate effectively in writing / Orally" 1. Clarity (Writing) 2. Grammar/Punctuation (Writing) 3. References (Writing) 4. Speaking Style (Oral) 5. Subject Matter (Oral)	**5**
PO 11	Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments (**Project Management and Finance).** 1. Scope Statement 2. Critical Success Factors 3. Deliverables 4. Work Breakdown Structure 5. Schedule 6. Budget 7. Quality 8. Human Resources Plan 9. Stakeholder List 10. Communication 11. Risk Register 12. Procurement Plan	**12**
PO 12	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change (**Life - Long Learning).** 1. Project management professional certification / MBA 2. Begin work on advanced degree 3. Keeping current in CSE and advanced engineering concepts 4. Personal continuing education efforts 5. Ongoing learning – stays up with industry trends/ new technology 6. Continued personal development 7. Have learned at least 2-3 new significant skills 8. Have taken up to 80 hours (2 weeks) training per year	**8**

KEY ATTRIBUTES FOR ASSESSING PROGRAM SPECIFIC OUTCOMES

PSO Number	NBA statement / Vital features (VF)	No. of VF's

PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking. 1. Identify the need and problem specific constraints 2. Develop computer programs related to Algorithms for specific problem / project. 3. Develop data centric applications using the concepts of Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking. 4. Design and analyze algorithms for problems. 5. Use data structures for developing solutions. 6. Apply appropriate algorithms for data processing.	**6**
PSO 2	Focus on improving software reliability, network security or information retrieval systems. 1. Design and develop software applications with a focus on high security and reliability. 2. Design and develop information retrieval systems for specific applications.	**2**
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies. 1. Identify the technical skills and Knowledge on advanced frameworks and platforms necessary for engineering practice and higher studies. 2. Extend the knowledge to become an entrepreneur	**2**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**MACHINE LEARNING**				
Course Code	AITC27				
Program	B.Tech				
Semester	VII				
Course Type	Professional Elective				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms. A Harika, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSC08	II	Probability and Statistics
B.Tech	ACIC01	VI	Data Mining and Knowledge Discovery

II COURSE OVERVIEW:

Machine learning (ML) is the study of computer algorithms that improve automatically through experience and by the use of data. Machine learning algorithms build a model based on sample data, known as ”training data”, in order to make predictions or decisions without being explicitly programmed to do so. Machine learning is a field of study that looks at using computational algorithms to turn empirical data into usable models. The machine learning field grew out of traditional statistics and artificial intelligences communities.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Machine Learning	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
40 %	Understand
60 %	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

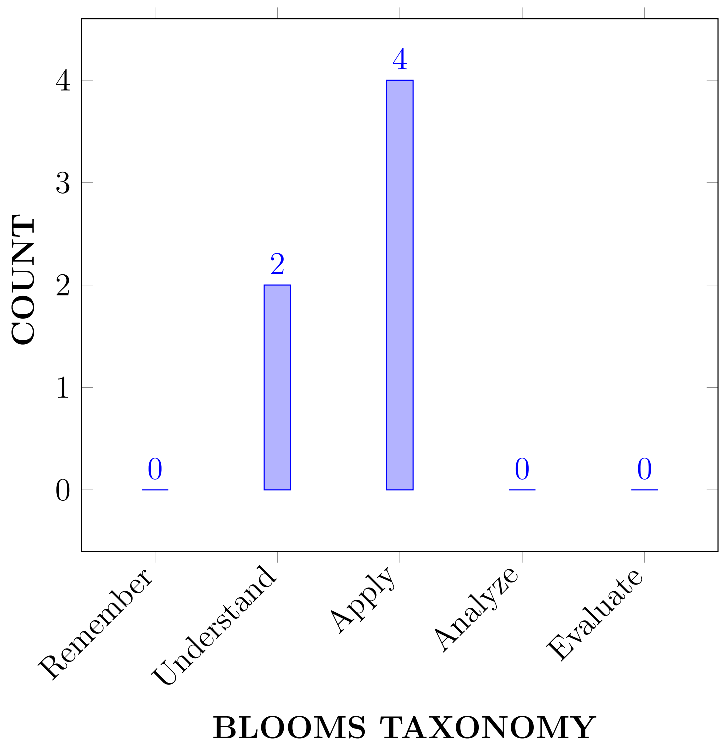
I	The concepts of machine learning and related algorithms.
II	The dimensionality problems using linear discriminates.
III	The various statistical models for analyzing the data.
IV	The clustering algorithms for unlabeled data.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Build** version space and consistent hypothesis to classify instances correctly.	Apply
CO 2	**Make use of** the concept of perceptron in solving appropriate problems for neural network learning.	Apply
CO 3	**Utilize** bayesian models to make predictions and robust decision making in uncertain environments.	Apply
CO 4	**Demonstrate** the expectation-maximization algorithm and its applications in various machine learning tasks.	Understand
CO 5	**Select** k-NN and locally weighted regression algorithms to solve classification and regression tasks.	Apply
CO 6	**Infer** the results of inductive and reinforcement learning models by evaluating their performance.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	SEE / CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE / CIE / AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	SEE / CIE / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	SEE / CIE / AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	1	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	2	SEE/AAT
PSO 2	Focus on improving software reliability, network security / information retrieval systems.	3	SEE/AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	-	✓
CO 2	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	-	✓
CO 4	✓	✓	✓	✓	-	-	-	-	-	✓	-	-	✓	-	-
CO 5	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 6	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Understand the concept of version space and hypothesis by understanding fundamentals of Computer engineering specialization and mathematical and scientific principles.	3
	PO 2	Identify problem of finding the correct hypothesis and understand the problem of consistent hypothesis and anaylze various hypothesis finding mechanisms.	6
	PO 3	Define consistent hypothesis and importance of considerations and manage the deriving process and evaluate the outcome.	4
	PO 10	Communicate effectively on consistent hypothesis including deep subject knowledge.	1
	PO 12	Understand various machine learning algorithms to stay up with new technology and for personal development.	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 1	Identify the need, key issues and applications of various machine learning techniques in various real time environments.	3
	PSO 3	Understand different machine learning algorithms, one can acquire knowledge on advanced topics for engineering practice and higher education and even can extend the knowledge to become an entrepreneur.	2
CO 2	PO 1	Understand the concept of perceptron by using mathematical principles, fundamental of Computer engineering specialization and scientific principles.	3
	PO 2	Identify the neural network problem and understand the problem statement of neural network collect the data needed for solving the problem then analyze different models of solutions and interpret the solutions	6
	PO 3	Define the back propagation algorithm, understand the user needs then identify the resources required next manage the design process and evaluate outcomes.	4
	PO 4	Have the knowledge of multi-layer network and understand the context in neural network problems and the solutions provided using the technical constructs like back propagation algorithm with their working strategies, these can be applied for understanding of other neural network problems.	5
	PO 10	Communicate effectively on multi-layer network using back propagation algorithm.	2
	PO 12	Understand the perceptron, one can personally continue understanding concepts of neural networks to stay up with new technology and for personal development.	2
	PSO 1	Identify the need for back propagation algorithm and apply appropriate algorithms for neural networks.	3
	PSO 2	Identify the need for perceptron and apply appropriate algorithms for information prediction.	2
	PSO 3	Make use of neural network for creating innovative carrer paths, to be an enterpreneur and desire for higher studies.	2
CO 3	PO 1	Understand the concept of bayesian models by using mathematical principles, fundamental of Computer engineering specialization and scientific principles	3
	PO 2	Bayesian belief networks is to provide a flexible and powerful framework for modeling uncertain and interdependent systems, making them valuable in fields such as artificial intelligence, machine learning, data analysis, risk assessment, and decision support.	4
	PO 3	Define Bayesian networks to calculate the probability distribution of unobserved variables given observed evidence.	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 4	Understand the characteristics of bayes optimal classifier, navie bayes classifier and its implementation in detail.	5
	PO 10	Communicate effectively on bias variance tradeoff and bayesian learning with clarity and explaining each technique with appropriate terminology.	1
	PO 12	understand the bayesian learning and EM algorithm computational learning theory and continue understanding the machine learning concepts to stay up with new technology and for personal development.	2
	PSO 1	Understand the concept of gibs algorithm, mistake bound model of learning and its applications in real life scenarios.	3
‘	PSO 3	Make use of bayesian learning and EM algorithm computational learning theory of machine learning for creating innovative carrer paths, to be an enterpreneur and desire for higher studies.	2
CO 4	PO 1	Understand the concept of expectation-maximization algorithm by applying the knowledge of computer engineering fundamentals, mathematical and scientific principles.	3
	PO 2	Identify the need for missing data, understand the problem statement of estimating the parameters of probabilistic models then analyze various models for dealing with incomplete data and interpret their results accordingly.	4
	PO 3	Define the problem of expectation and maximization algorithm as an iterative optimization technique to estimate parameters of probabilistic models.	3
	PO 4	Understand the mistake bound model of learning to analyze the performance of machine learning algorithms for binary classification tasks.	5
	PO 10	Communicate on expectation-maximization algorithm them in detail.	2
	PSO 1	Understand the concept of EM algorithm, mistake bound model of learning and its applications in real life scenarios.	3
CO 5	PO 1	Understand the concept of classification and regression by using the knowledge of computer engineering fundamentals, mathematical and scientific principles.	3
	PO 2	Identify the need for decision making, understand the problem statement of classification, by collecting the training data.	6
	PO 3	Define the problem of classification, understand the user needs then define the k-nearest neighbor algorithm for classification and manage theclassification process.	4
	PO 4	Define the problem of classification and regression and its appropriate algorithms in machine learning.	5

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	Communicate effectively on lazy and eagar learning in instance based learning.	2
	PO 12	Understand the concept of genetic programming to stay up with new technology and for personal development.	2
	PSO 1	Communicate effectively on classification and regression techniques with clarity using k-nearest neighbor, locally weighted regression with real time data.	3
	PSO 2	Use radial basis functions interpolation to estimate the values of unknown points based on the values of known data points.	2
	PSO 3	Make use of radial basis functions and case based learning algorithms of machine learning for creating innovative carrer paths, to be an enterpreneur and desire for higher studies.	2
CO 6	PO 1	Explain the importance of inductive analytical approaches to learning by applying knowledge of computer science fundamentals.	2
	PO 2	Explain the importance of Q-learning in solving Markov decision processes without prior knowledge of environment dynamics.	6
	PO 3	Explain the importance of reinforcement algorithm used for training agents in sequential decision making tasks.	3
	PO 10	Communicate on inductive and reinforcement learning in machine learning in detail.	2
	PSO 1	Understand the concept of various machine learning strategies for higher education and even can extend the knowledge to become an entrepreneur.	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	6	4	-	-	-	-	-	-	1	-	2	3	-	2
CO 2	3	6	4	5	-	-	-	-	-	2	-	2	3	2	2
CO 3	3	4	4	5	-	-	-	-	-	1	-	2	3	-	2
CO 4	3	4	3	5	-	-	-	-	-	2	-	-	3	-	-
CO 5	3	6	4	5	-	-	-	-	-	2	-	2	3	2	2
CO 6	2	6	3	-	-	-	-	-	-	2	-	-	3	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	60	40	-	-	-	-	-	-	20	-	25	50	-	100
CO 2	100	60	40	45	-	-	-	-	-	40	-	25	50	100	100
CO 3	100	40	40	45	-	-	-	-	-	20	-	25	50	-	100
CO 4	100	40	30	45	-	-	-	-	-	40	-	-	50	-	-
CO 5	100	60	40	45	-	-	-	-	-	40	-	25	50	100	100
CO 6	67	60	30	-	-	-	-	-	-	40	-	-	50	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -5 $< C \leq 40\%$ – Low/ Slight
2 - 40 % $< C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	-	-	-	-	-	-	1	-	1	2	-	3
CO 2	3	3	2	2	-	-	-	-	-	2	-	1	2	3	3
CO 3	3	2	2	2	-	-	-	-	-	1	-	1	2	-	3
CO 4	3	2	1	2	-	-	-	-	-	2	-	-	2	-	-
CO 5	3	3	2	2	-	-	-	-	-	2	-	1	2	3	3
CO 6	3	3	1	-	-	-	-	-	-	2	-	-	2	-	-
TOTAL	18	16	10	8	-	-	-	-	-	10	-	4	12	6	12
AVERAGE	3	2.7	1.6	2	-	-	-	-	-	1.6	-	1	2	3	3

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	✓				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

-	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**TYPES OF MACHINE LEARNING**
	Concept learning: Introduction, version spaces and the candidate elimination algorithm; Learning with trees: Constructing decision trees, CART, classification example.
MODULE II	**ARTIFICIAL NEURAL NETWORKS**
	Introduction, neural network representations, Appropriate problems for neural network learning, perceptions, Multi-layer networks and the Back propagation algorithms, An illustrative example: Face recognition, advanced topics in Artificial neural networks.
MODULE III	**BAYESIAN LEARNING**
	Averages, variance and covariance, the Gaussian; The bias-variance tradeoff, Bayesian learning: Introduction, Bayes theorem, Bayes optimal classifier, naïve Bayes classifier, Gibs algorithm, Bayesian belief networks. The EM algorithm Computational learning theory: Introduction, probably learning an approximately correctly hypothesis sample complexity for finite hypothesis spaces, sample complexity for infinite hypothesis spaces, the mistake bound model of learning
MODULE IV	**INSTANCE BASED LEARNING**
	Introduction, k-nearest neighbor algorithm, locally weighted regression, Radial basis functions case based learning, remarks on lazy and eager learning. Genetic Algorithms, genetic operators; Genetic programming.
MODULE V	**INDUCTIVE AND REINFORCEMENT LEARNING**
	Motivation, Inductive analytical approaches to learning, using prior knowledge to alter the search objective. Introduction, The learning Task.Q Learning, On deterministic Rewards and Actions, Temporal Difference programming, Generating from examples, relationship to dynamic programming

TEXTBOOKS

1. Tom M. Mitchell, "Machine Learning ", McGraw Hill, 1st Edition, 2013.
2. Stephen Marsland, "Machine Learning- An Algorithmic Perspective ", CRC Press, 1st Edition, 2009.

REFERENCE BOOKS:

1. Margaret H Dunham, "Data Mining", Pearson Edition, 2nd Edition, 2006.
2. Galit Shmueli, Nitin Rel, Peter C Bruce, "Data Mining for Business Intelligence", John Wiley and Sons, 2nd Edition,2007.
3. Rajjal Shinghal, "Pattern Recognition and Machine Learning", Springer-Verlag, New York, 1st Edition, 2006.

WEB REFERENCES:

1. https://www.oracle.com/in/cloud/application-development
2. http://computingcareers.acm.org/?pageid=12
3. http://en.wikibooks.org/wiki/cloudapplication

COURSE WEB PAGE:

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
2	Concept learning: Introduction	CO 1	T1:1.1-1.4
3	Version spaces	CO 1	T1:1.5
4	The candidate elimination algorithm	CO 1	T1:2.2
5	Learning with trees	CO 1	T1:2.2
6	Constructing decision trees	CO 1	T1:2.1-2.2
7	CART	CO 1	T1:2.3-2.5
8	Classification example	CO 1	T1:2.6
9	ANN Introduction	CO 2	T1:2.7-2.8
10	Neural network representations	CO 2	T1:3.1-3.2
11	Appropriate problems for neural network learning	CO 2	T1:3.2-3.4
12	Perceptions	CO 2	T1:5.2
13	Multi-layer networks	CO 2	T1:5.3
14	The Back propagation algorithms,	CO 2	T1:5.3
15	An illustrative example: Face recognition	CO 2	T1:5.3
16	Advanced topics in Artificial neural networks	CO 2	T1:5.4-5.5

17	Averages, variance and covariance, the Gaussian	CO 3	T1:5.6, 21.4
18	The bias-variance tradeoff	CO 3	T1:6.1
19	Bayesian learning:Introduction	CO 3	T1:6.2-6.3
20	Bayes theorem	CO 3	T1:6.4
21	Bayes optimal classifier	CO 3	T1:6.5
22	Naïve Bayes classifier	CO 3	T1:6.6-6.7
23	Gibs algorithm, Bayesian belief networks.	CO 3	T1:8.1
24	The EM algorithm Computational learning theory: Introduction	CO 4	T1:8.2
25	Probably learning an approximately correctly hypothesis	CO 4	T1:8.3
26	Sample complexity for finite hypothesis spaces,	CO 4	T1:8.3
27	Sample complexity for infinite hypothesis spaces	CO 4	T1:8.4-8.5
28	The mistake bound model of learning	CO 4	T1:8.6
29	Instance based learning : Introduction	CO 5	T1:8.6
30	k-nearest neighbor algorithm	CO 5	T1:9.5
31	Locally weighted regression	CO 5	T1:9.6
32	Radial basis functions case based learning,	CO 5	T1:10.1-10.2
33	Remarks on lazy and eager learning	CO 5	T1:10.3
34	Genetic Algorithms	CO 5	T1:10.5
35	Genetic operators	CO 5	T1:10.6
36	Genetic programming	CO 5	T1:10.6
37	Inductive and Reinforcement learning motivation	CO 6	T1:11.3
38	Inductive analytical approaches to learning	CO 6	T1:11.4
39	using prior knowledge to alter the search objective	CO 6	T1:11.5
40	Reinforcement learning introduction	CO 6	T1:11.6
41	The learning Task	CO 6	T1:12.1-12.3
42	Q Learning	CO 6	T1:12.4-12.6
43	Non deterministic Rewards and Actions.	CO 6	T1:12.7-12.8
44	Temporal Difference programming	CO 6	T1:7.1-7.2
45	Generating from examples	CO 6	T1:8.1
46	Relationship to dynamic programming	CO 6	T1:8.2

PROBLEM SOLVING/ CASE STUDIES			
1	Suppose the company's dataset contains information on 100 used cars with the following attributes: Car Age: [5, 3, 7, 2, 4, 6, 1, 8, 3, 2, ...] (in years) Mileage: [50000, 30000, 80000, 20000, 40000, 60000, 10000, 90000, 30000, 25000, ...] (in kilometers) Fuel Type: [Petrol, Diesel, CNG, Petrol, Diesel, Petrol, Diesel, CNG, Petrol, Diesel, ...] Number of Doors: [4, 2, 4, 2, 4, 2, 4, 2, 4, 4, ...] Horsepower: [150, 120, 100, 180, 130, 110, 200, 90, 120, 140, ...] (in horsepower) Price: [20000, 18000, 15000, 22000, 19000, 16000, 23000, 17000, 18000, 21000, ...] (in dollars) The automobile company plans to predict the prices of used cars in their inventory using the CART algorithm. Outline the steps they need to follow to achieve this goal. Additionally, explain the importance of interpreting the decision tree structure generated by the CART algorithm for this prediction task, given the example values provided above.	CO 1	T1:5.3-5.3
2	Consider two perceptrons defined by the threshold expression wo + w1x1+ w2x2 > 0. Perceptron A has weight values w0=1, w1=2, w2=1 and perceptron B has the weight values w0=0, w1=2, w2=1 True or false? Perceptron A is more-general hanp erceptron B.	CO 2	T1:8.1-8.3
3	Consider a two-layer feedforward ANN with two inputs a and b, one hidden unit c, and one output unit d. This network has five weights (wca, wcb, wco, wdc, wdo), where w,o represents the threshold weight for unit x. Initialize these weights to the values (. 1, .1, .1, .1, .1), then give their values after each of the first two training iterations of the backpropagation algorithm. Assume learning rate, n = .3, momentum, alpha = 0.9, incremental weight updates, and the following training examples: a b d 1 0 1 0 1 0	CO 2	T1:8.4-8.6 T1:9.1-9.2
4	For a two-class problem, generate normal samples for two classes with different variances, then use parametric classification to estimate the discriminant points. Compare these with the theoretical values	CO 3	T1:9.4-9.6

5	Consider the concept learning algorithm FindG, which outputs a maximally general consistent hypothesis (e.g., some maximally general member of the version space). (a) Give a distribution for P(h) and P(D|h) under which FindG is guaranteed to output a MAP hypothesis. (6) Give a distribution for P(h) and P(D|h) under which FindG is not guaranteed to output a MAP hypothesis. (c) Give a distribution for P(h) and P(D|h) under which FindG is guaranteed to output a ML hypothesis but not a MAP hypothesis.	CO 3	T1:11.3-11.6
6	Suggest a lazy version of the eager decision tree learning algorithm ID3. What are the advantages and disadvantages of your lazy algorithm compared to the original eager algorithm?	CO 2	T1:12.1-12.6
7	Consider the following quadratic function: $f(x) = 2x^2 - 8x + 6$ Your task is to use the Gradient Descent algorithm to find the minimum value of this quadratic function. Implement the steps of the Gradient Descent algorithm and show the updates to the value of 'x' at each iteration. Start with an initial value of 'x' = 0 and a learning rate of 0.1. Perform the iterations until the change in the value of 'x' becomes very small (converges) or reaches a maximum number of iterations.	CO 4	T1:11.3-11.6
8	You are given a dataset containing information about three types of iris flowers: Setosa, Versicolor, and Virginica. Each sample in the dataset has four features: sepal length, sepal width, petal length, and petal width. Your task is to build a k-Nearest Neighbor (k-NN) classifier to classify iris flowers based on these features. Sepal Length (in centimeters): [5.1, 4.9, 5.7, 6.4, 5.5, ...] Sepal Width (in centimeters): [3.5, 3.0, 2.8, 2.9, 4.0, ...] Petal Length (in centimeters): [1.4, 1.4, 4.1, 5.3, 1.3, ...] Petal Width (in centimeters): [0.2, 0.2, 1.3, 2.3, 0.2, ...] Flower Type: [Setosa, Setosa, Versicolor, Virginica, Setosa, ...]	CO 5	T1:12.1-12.6
9	To handle non-linearity to use Locally Weighted Regression (LWR) to make more accurate predictions. Size of the House (in square feet): [1000, 1500, 1200, 1800, 2000, ...] Number of Bedrooms: [2, 3, 2, 4, 3, ...] Location: [Neighborhood A, Neighborhood B, Neighborhood A, Neighborhood C, Neighborhood B, ...] Sale Price of the House (in dollars): [250000, 350000, 280000, 420000, 500000, ...]	CO 5	

10	SolveTraveling Salesman Problem with a small dataset of cities and their coordinates using genetic operators Coordinates of Cities (x, y): City 1: (2, 3) City 2: (5, 1) City 3: (6, 7) City 4: (4, 9) City 5: (8, 4)	CO 6	T1:12.8-12.9
11	In your everyday newspaper, find five sample news reports for each category of politics, sports, and the arts. Go over these reports and find words that are used frequently for each category, which may help us discriminate between different categories. For example, a news report on politics is likely to include words such as "government," "recession," "congress," and so forth, whereas a news report on the arts may include "album," "canvas," or "theater." There are also words such as "goal" that are ambiguous.	CO 5	T1:18
12	Assume we are given the task to build a system that can distinguish junk email. What is in a junk e-mail that lets us know that it is junk? How can the computer detect junk through a syntactic analysis? What would you like the computer to do if it detects a junk e-mail delete it automatically, move it to a different file, or just highlight it on the screen?	CO 5	T1:19
13	Let us say you are given the task of building an automated taxi. Define the constraints. What are the inputs? What is the output? How can you communicate with the passenger? Do you need to communicate with the other automated taxis, that is, do you need a "language"?	CO 2	T1:28
14	Let us say our hypothesis class is a circle instead of a rectangle. What are the parameters? How can the parameters of a circle hypothesis be calculated in such a case? What if it is an ellipse? Why does it make more sense to use an ellipse instead of a circle? How can you generalize your code to K greater than 2 classes?	CO 3	T1:12
15	Imagine our hypothesis is not one rectangle but a union of two (or m greater than 1) rectangles. What is the advantage of such a hypothesis class? Show that any class can be represented by such a hypothesis class with large enough m	CO 1	T1:18
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Types of Machine Learning	CO 1	T1:1.2
2	Artificial Neural Networks	CO 2	T1:1.5
3	Bayesian Learning	CO 3, CO 4	T1:8,9
4	Instance based learning	CO 5	T1:10,11
5	Inductive and Reinforcement learning	CO 6	T1:9.1

DISCUSSION OF QUESTION BANK			
1	Types of Machine Learning	CO 1	T1:1.2
2	Artificial Neural Networks	CO 2	T1:1.5
3	Bayesian Learning	CO 3, CO 4	T1:8,9
4	Instance based learning	CO 5	T1:10,11
5	Inductive and Reinforcement learning	CO 6	T1: 9.1

Signature of Course Coordinator **HOD, CSE**
A. Harika, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Course Title	**BIG DATA AND ANALYTICS LABORATORY**				
Course Code	ACSC34				
Program	B.Tech				
Semester	VII	CSE			
Course Type	Core				
Regulation	IARE - UG 20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
		-	-	3	1.5
Course Coordinator	MR M.HARI KRISHNA,ASSISTANT Professor				

I COURSE PRE-REQUISITES:

Level	**Course Code**	**Semester**	**Prerequisites**
B.TECH	ACSB09	III	DBMS Laboratory
B.TECH	AITB06	IV	OOP Through Java Laboratory
B.TECH	AITB13	VI	LINUX Laboratory
B.TECH	ACSB15	VI	DWDM Laboratory

II COURSE OVERVIEW:

This course introduces the demonstration of operations on image and audio (speech)data using Python libraries. It focuses on image processing basics such as intensity transformations, spatial filtering, histogram equalizations etc. It also includes speech processing basics such as reading and displaying an audio file, converting speech to text and vice versa, usage of various speech APIs.

III MARKS DISTRIBUTION:

Subject	**SEE Examination**	**CIE Examination**	**Total Marks**
Big Data and Analytics Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

X	Demo Video	✓	Lab Worksheets	✓	Viva Questions	X	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

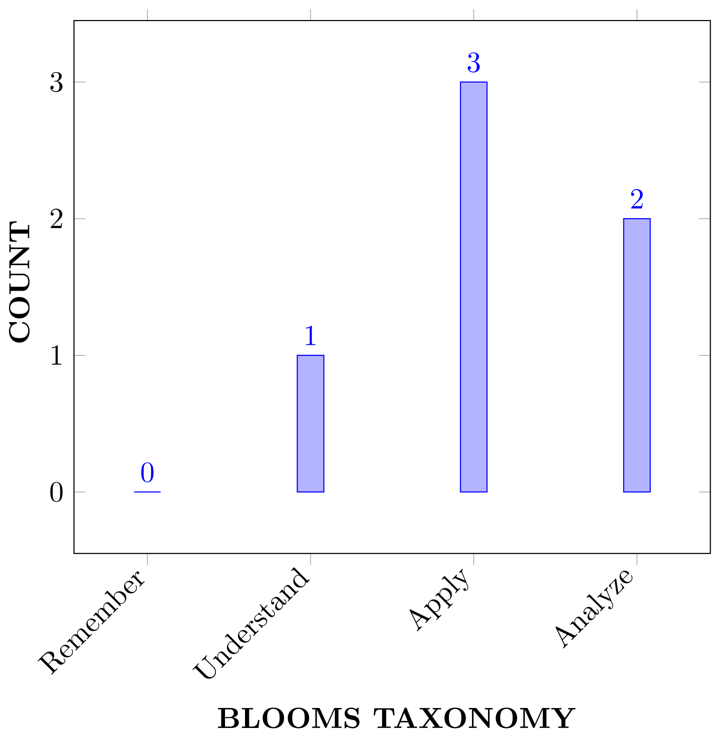
I	The steps involved in creating distributed environment.
II	The platform for creating and run big data MapReduce programs on Hadoop.
III	Fundamental techniques and principles in achieving big data analytics with scalability and streaming capability..
IV	The digital image processing techniques for edge detection.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** distributed environment and its ecosystem with the help of VMWare and Linux commands.	Understand
CO 2	**Make use of** hadoop distributed file management modes for handling big data in business analytics.	Apply
CO 3	**Analyze** the Big Data using Map-reduce programming in Hadoop framework for memory management and fault recovery.	Analyze
CO 4	**Apply** Hive commands for reading, writing and managing large datasets in HDFS .	Apply
CO 5	**Implement** the Pig Latin scripts in two different modes to perform a particular operation on the data that exists in the HDFS.	Apply
CO 6	**Analyze** adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Program Outcomes	
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / SEE/ Lab Exercises
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	3	CIE / SEE/ Lab Exercises

PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	CIE / SEE/ Lab Exercises
PO 5	**Modern tool usage:** UCreate, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	CIE / SEE/ Lab Exercises

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 2	Focus on improving software reliability, network security or information retrieval systems	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	2	3	-	2	-	-	-	-	-	-	-	-	3	-
CO 3	-	3	3	-	3	-	-	-	-	-	-	-	-	3	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	-	3	2	-	2	-	-	-	-	-	-	-	-	-	-
CO 2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	**Describe**distributed environment and its ecosystem with the help of VMWare and Linux commands **using principles of mathematics, science, and engineering fundamentals.**	3
	PO 2	**Describe** distributed environment and its ecosystem withthe help of VMWare and Linux commands. with Problem statement and system definition ,Problem formulation and abstraction	2
CO 2	PO 1	**Demonstrate** ehadoop distributed file management modes for handling big data in business analytics **basic fundamentals of mathematics and engineering fundamentals.**	3
	PO 2	**Demonstrate** hadoop distributed file management modes for handling big data in business analytics **Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation** .	3
	PO 3	**Demonstrate**hadoop distributed file management modes for handling big data in business analytics **to Investigate and define a problem and identify constraints Manage the design process and evaluate outcomes**	4
	PO 5	**Demonstrate**hadoop distributed file management modes for handling big data in business analytics **by Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature , Understanding of appropriate codes of practice and industry standards.**	4
	PSO 2	**Demonstrate** hadoop distributed file management modes for handling big data in business analytics **by using a set of steps.**	2
CO 3	PO 2	**Make Use of**Constructs Map-reduce programming in Hadoop framework for **Model Translation ,Solution development and interpretation of results in Big Data Problems.**	2
	PO 3	**Make Use of** Constructs Map-reduce programming in Hadoop framework for memory management and fault recovery in view of **Investigating and define a problem and identify constraints, Manage thedesign process and evaluate the outcomes**	2
	PO 5	**Make Use of**Constructs Map-reduce programming in Hadoop framework for computer software. **by Understanding of contexts in which engineering knowledge and industry standards.**	2

	PSO 2	**Make Use of** Big Data using Map-reduce programming in Hadoop framework for memory management and fault recovery **by using a set of steps.**	7
CO 4	PO 1	**Define**Hive commands for reading, writing and managing large datasets in hdfs **the knowledge of mathematics, science, and engineering fundamentals.**	2
	PO 2	**Define**Hive commands for reading, writing and managing large datasets in hdfs**s the Problem statement and system definition, Problem formulation and abstraction , Information and data collection, Model translation**	4
CO 5	PO 2	**Model**the Pig Latin scripts in two different modes to perform a particular operation on the data that exists in the HDFS **with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation.**	3
	PO 3	**Model**the Pig Latin scripts in two different modes to perform a particular operation on the data that exists in the HDFS by **Investigating and define a problem and identify constraints, Manage the design process and evaluate the outcomes**.	3
	PO 5	**Model** the Pig Latin scripts in two different modes to perform a particular operation on the data that exists in the HDFS. by**Understanding of contexts in which engineering knowledge can be applied, Understanding use of industry standards.**	3
	PSO 2	**Model** l the Pig Latin scripts in two different modes to perform a particular operation on the data that exists in the HDFS**by using sequence of steps.**	2
CO 6	PO 1	Illustrat adequate perspectives of big data analytics in various applications like recommender systems, social media applications by using **Mathematical principles,Scientific principles and methodology .**	3
	PO 2	**Illustrate** adequate perspectives of big data analytics in various applications like recommender systems, social media applications Mathematical principles,Scientific principles and methodology	3

XV SYLLABUS:

WEEK 1	**INSTALL VMWARE**
	1. Problem Statement: Download and Install American Commercially and Cloud Computing technology to Virtualize X86 Architecture. VMware Workstation Pro is the industry standard for running multiple operating systems as virtual machines (VMs) on a single Linux or Windows PC to build, test, or demo software. **Solutions Expected:** 1.website link https://www.vmware.com/tryvmware/?p=workstation-w 2. installation of VMware Workstation 16.2.4 Version. 3. Supporting environment(Hadoop) 4. Running a basic application/VMware a. First of all, enter to the official site of VMware and download VMware Workstation https://www.vmware.com/tryvmware/?p=workstation-w b. After downloading VMware workstation, install it on your PC. c.Setup will open Welcome Screen. Click on Next button and choose Typical option. d. By clicking "Next" buttons, to begin the installation, click on Install button at the end.
WEEK 2	**HADOOP MODES**
	2.Problem Statement: The supporting Environment for VMWare mainly works on 3 different modes.This experiment is mainly to setup install in 3 different Operating mode. Perform setting up and Installing Hadoop in its three operating modes.Standalone,Pseudo distributed,Fully distributed.Use web based tools to monitor your Hadoop setup. **Solutions Expected:** 1. http://archive.apache.org/dist/hadoop/core/hadoop-1.2.0/hadoop-1.2.0.tar.gz. 2. Download and Install Version Hadoop 3.3.4(Compatible version). 3. Installation of jdk 7. 4. Command: sudo apt-get install openjdk-7-jdk. 5. Download and extract Hadoop Command: wget http://archive.apache.org/dist/hadoop/core/hadoop-1.2.0/hadoop-1.2.0.tar.gz Command: tar -xvf hadoop-1.2.0.tar.gz Command: sudo mv hadoop-1.2.0 /usr/lib/hadoop

WEEK 3	**USING LINUX OPERATING SYSTEM**
	3.Problem Statement: Interpret distributed environment and its ecosystem with the help of VMWare and Linux commands by Implementing the basic commands of LINUX Operating System – File/Directory creation, deletion, update operations **Solutions Expected:** a. Install Linux Operating system.Linux is an open-source Unix-like operating system based on the Linux kernel. b. Implement the basic commands File/Directory creation, deletion, update operations. c.In Linux, process running independently of the shell. One can leave the terminal window and, but process executes in the background without any interaction from users. For example, Apache or Nginx web server always runs in the background to serve you images and dynamic content. d. Simplify the difference between Linux and windows commands?
WEEK 4	**FILE MANAGEMENT IN HADOOP**
	Problem Statement: Construct Hadoop distributed file management modes for handling big data in business analytics. Demonstrate distributed environment and its ecosystem with the help of VMWare and Linux commands. Implement the following file management tasks in Hadoop:Adding files and directories ,Retrieving files ,Deleting filesHint: A typical Hadoop workflow creates data files (such as log files)elsewhere and copies them into HDFS using one of the above command line utilities **Solutions Expected:** a. Adding Files and Directories to HDFS: hadoop fs -mkdir /user/chuck hadoop fs -put hadoop fs -put example.txt /user/chuck. b. Retrieving Files from HDFS. The Hadoop command get copies files from HDFS back to the local filesystem. To retrieve example.txt, we can run the following command: hadoop fs -cat example.txt Deleting files from HDFS hadoop fs -rm example.txt Command for creating a directory in hdfs is “hdfs dfs –mkdir /lendicse”. Adding directory is done through the command “hdfs dfs –put lendi-english /”. C. Define Hadoop? List out the various use cases of Hadoop? What are the differences between regular Filesystem and HDFS? d. Implement the following file management tasks in Hadoop:Adding files and directories , Retrieving files ,Deleting files newline e. A typical Hadoop workflow creates data files (such as log files)elsewhere and copies them into HDFS using one of the above command line utilities

WEEK 5	**MAPREDUCE PROGRAM 1**
	5.Problem Statement: Analyze Big Data using Map-reduce programming in Hadoop framework for memory management and faulty recovery. we find out the frequency of each word. Here, the role of Mapper is to map the keys to the existing values and the role of Reducer is to aggregate the keys of common values. So, everything is represented in the form of Key-value pair. Run a basic word count Map Reduce program to understand Map Reduce Paradigm **Solutions Expected:** a. Run a basic word count Map Reduce program to understand Map Reduce Paradigm. b. Illustrate is MapReduce? Describe are the main components of MapReduce? c. Run a basic word count Map Reduce program to understand Map Reduce Paradigm d. Define what is block in HDFS? Why is a block in HDFS so large? e. WordCount fits very well with the MapReduce programming model making it a great example to understand the Hadoop Map/Reduce programming style. Our implementation consists of three main parts: 1. Mapper 2. Reducer 3. Driver

WEEK 6	**WORKING WITH AUDIO FILES**
	Problem Statement: In Hadoop, MapReduce is a computation that decomposes large manipulation jobs into individual tasks that can be executed in parallel across a cluster of servers. The results of tasks can be joined together to compute final results. Analyze Big Data using Map-reduce programming in Hadoop framework for memory management and faulty recovery. Write a Map Reduce program that mines weather data.Hint: eather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented. **Solutions Expected:** a.WordCount is a simple program which counts the number of occurrences of each word in a given text input data set.WordCount fits very well with the MapReduce programming model making it a great example to understand the Hadoop Map/Reduce programming style. Our implementation consists of three main parts: 1. Mapper 2. Reducer 3. Driver b. Explain the function of MapReducer partitioner? What is the difference between an Input Split and HDFS Block? What is Sequencefileinputformat? c. Write a Map Reduce program that mines weather data.Hint: Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented. d. In Hadoop what is InputSplit? Explain what is a sequence file in Hadoop?
WEEK 7	**MAPREDUCE PROGRAM 3**
	7.Problem Statement: MapReduce is a technique in which a huge program is subdivided into small tasks and run parallelly to make computation faster, save time, and mostly used in distributed systems.Analyze Big Data using Map-reduce programming in Hadoop framework for memory management and faulty recovery. Implement matrix multiplication with Hadoop Map Reduce **Solutions Expected:** a. The path of the input file or directory for matrix A. The path of the input file or directory for matrix B. The path of the directory for the output files for matrix C. strategy = 1, 2, 3 or 4. R = the number of reducers. I = the number of rows in A and C. K = the number of columns in A and rows in B. J = the number of columns in B and C. IB = the number of rows per A block and C block. KB = the number of columns per A block and rows per B block. JB = the number of columns per B block and C block. b. Explain what is “map” and what is “reducer” in Hadoop? Mention what daemons run on a master node and slave nodes? Mention what is the use of Context Object? c. Implement matrix multiplication with Hadoop Map Reduce. d. Label the partitioner in Hadoop? Explain of RecordReader in Hadoop?

WEEK 8	**PIG LATIN LANGUAGE – PIG**
	8.Problem Statement: Pig is an open-source high level data flow system. It provides a simple language called Pig Latin, for queries and data manipulation, which are then compiled in to MapReduce jobs that run on Hadoop. Implement the Pig Latin scripts in two different modes to perform a particular operation on the data that exists in the HDFS .Installation of PIG. **Solutions Expected:** a. By using Pig, we can perform all the data manipulation operations in Hadoop. In addition, Pig offers a high-level language to write data analysis programs which we call as Pig Latin. One of the major advantages of this language is, it offers several operators. b. 1)Extract the pig-0.15.0.tar.gz and move to home directory 2) Set the environment of PIG in bashrc file. 3) Pig can run in two modes Local Mode and Hadoop Mode Pig –x local and pig 4) Grunt Shell Grunt ¿ 5) LOADING Data into Grunt Shell DATA = LOAD ¡CLASSPATH¿ USING PigStorage(DELIMITER) as (ATTRIBUTE : DataType1, ATTRIBUTE : DataType2. . . ..) 6) Describe Data Describe DATA; 7) DUMP Data Dump DATA; c. Illustrate do you mean by a bag in Pig? Differentiate between PigLatin and HiveQL Choose the contents of two or more relations and divide a single relation into two or more relations? d. Installation of Apache PIG Software which is an open-source high level data flow system. e. Attain the usage of for each operation in Pig scripts? What does Flatten do in Pig
WEEK 9	**FILTER BANKS - 2**

	9.Problem Statement: Pig is a high level scripting language that is used with Apache Hadoop. ... Pig works with data from many sources, including structured and unstructured data, and store the results into the Hadoop Data File System. Pig scripts are translated into a series of MapReduce jobs that are run on the Apache Hadoop cluster.Implement the Pig Latin scripts in two different modes to perform a particular operation on the data that exists in the HDFS . Write Pig Latin scripts sort, group, join, project, and filter your data.
	
	Solutions Expected:
	a. Apache Pig a tool/platform which is used to analyze large datasets and perform long series of data operations. Pig is used with Hadoop. All pig scripts internally get converted into map-reduce tasks and then get executed. It can handle structured, semi-structured and unstructured data. Pig stores, its result into HDFS
	b. The following of the steps are considered for Write Pig Latin scripts sort, group, join, project, and filter your data.
	c. FILTER Data FDATA = FILTER DATA by ATTRIBUTE = VALUE;
	d. GROUP Data GDATA = GROUP DATA by ATTRIBUTE;
	e. Iterating Data FOR-DATA = FOREACH DATA GENERATE GROUP AS GROUP-FUN, ATTRIBUTE = ¡VALUE¿

WEEK 10	**PIG LATIN MODES, PROGRAMS**
	10.Problem Statement: To start with the word count in pig Latin, you need a file in which you will have to do the word count.It is a PDF file and so you need to first convert it into a text file which you can easily do using any PDF to text converter.Here are both PDF and Text file for your reference. It is recommended for you to download both the file to start with word count example in pig Latin.Implement the Pig Latin scripts in two different modes to perform a particular operation on the data that exists in the HDFS .Run the Pig Latin Scripts to find Word Count Run the Pig Latin Scripts to find a max temp for each and every year. **Solutions Expected:** a. Run the Pig Latin Scripts to find Word Count. b. Run the Pig Latin Scripts to find Word Count. c. lines = LOAD '/user/hadoop/HDFS-File.txt' AS (line:chararray); d. words = FOREACH lines GENERATE FLATTEN(TOKENIZE(line)) as word; grouped = GROUP e. Perform the Process words by word for Word count;
WEEK 11	**HIVE**
	11.Problem Statement: The Apache Hive data warehouse software facilitates reading, writing, and managing large datasets residing in distributed storage using SQL. Structure can be projected onto data already in storage. A command line tool and JDBC driver are provided to connect users to Hive.Apply Hive commands for reading, writing and managing large datasets in HDFS. Installation of HIVE for reading, writing and managing large datasets in HDFS by applyiong HIVE Commands **Solutions Expected:** a. Apache Hive is a data warehouse software project built on top of Apache Hadoop for providing data query and analysis. b. Install MySQL-Server c. Sudo apt-get install mysql-server d. Configuring MySQL UserName and Password e. Creating User and granting all Privileges Mysql –uroot –proot

WEEK 12	**HIVE OPERATIONS**
	12.Problem Statement: Hive is a data warehouse infrastructure tool to process structured data in Hadoop. It resides on top of Hadoop to summarize Big Data, and makes querying and analyzing easy.Apply Hive commands for reading, writing and managing large datasets in HDFS. .Use Hive commands to create, alter, and drop databases, tables, views, functions, and indexes for reading, writing and managing large datasets in HDFS **Solutions Expected:** a. The Hive Query Language (HiveQL) is a query language for Hive to process and analyze structured data in a Metastore. b. SELECT statement is used to retrieve the data from a table. WHERE clause works similar to a condition. It filters the data using the condition and gives you a finite result. c. The built-in operators and functions generate an expression, which fulfils the condition. d. SYNTAX for HIVE Database Operations DATABASE Creation. e. Drop Database Statement.

TEXTBOOKS

1. Rajiv Sabherwal, Irma Becerra- Fernandez, “Business Intelligence –Practice, Technologies and Management”, John Wiley, 1st Edition, 2011

REFERENCE BOOKS:

1. Jay Liebowitz, “Big Data and Business Analytics Laboratory”, CRC Press.

XVI COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO’s	Reference
1	Install VMware.	CO 1	T1:4.1, T2:1.1
2	Hadoop Modes	CO 2	T1:4.9,4.11, T2:7
3	Using Linux Operating System	CO 3,CO4	T1:3, T2:8
4	File Management In Hadoop	CO1,CO 4	T1:6.6, T2:12
5	Mapreduce Program 1	CO 3	T1:4.4, T2:10
6	Mapreduce Program 2	CO 3	T1:4.6, T2:10
7	Mapreduce Program 3	CO 5	T2:15
8	Pig Latin Language – Pig.	CO 6	T2:18
9	Pig Commands.	CO 5	T2:18
10	Pig Latin Modes, Pig Program	CO6	R1: 10
11	Hive	CO 4	R4:7
12	Hive Operations	CO 5	T1:2, T2:1

XVII EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Implementation of application that stores big data in MongoDB
2	Experimental Methods for the Evaluation of Big Data Systems.
3	Simplified data processing on large clusters by using mapreduce.
4	Using virtual clusters to decouple computation and data management in high throughput analysis applications.
5	Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data

Signature of Course Coordinator **HOD,CSE**
Mr M.Hari krishna, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Course Title	**CLOUD APPLICATION DEVLOPMENT LABORATORY**				
Course Code	ACSC33				
Program	B.Tech				
Semester	VII	CSE			
Course Type	Core				
Regulation	UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Mr.P.Suresh Kumar, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITB13	VI	Linux Programming Laboratory
B.Tech	ACSB09	IV	Database Management Systems Laboratory
B.Tech	ACSB02	IV	Programming for Problem Solving Laboratory

II COURSE OVERVIEW:

This Laboratory course provides a foundation for which we can access the applications as utilities over the internet. It allows us to create, configure, and customize the business applications online. a cloud application, or cloud app, is a software program where cloud-based and local components work together. This model relies on remote servers for processing logic that is accessed through a web browser with a continual internet connection. Hadoop is an open-source framework that allows to store and process big data in a distributed environment across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Cloud Application Development Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component	**Laboratory**		**Total Marks**
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

VI COURSE OBJECTIVES:

The students will try to learn:

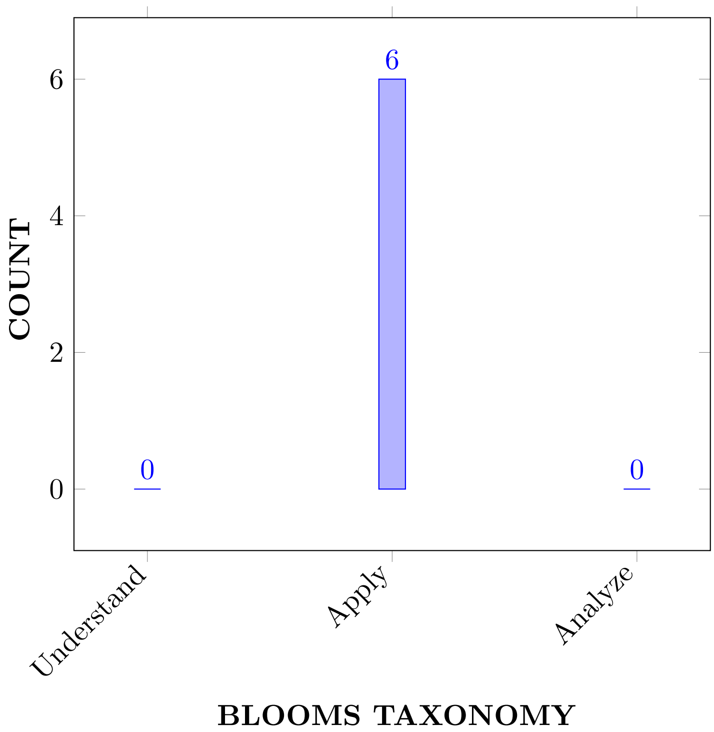
I	To run virtual machines of different configuration.
II	Big data application using Hadoop under cloud environment.
III	The developing web applications in cloud framework.
IV	The developing web applications in cloud devlopment which provides security.
V	The developing cloud application using Amazon Web Service.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Make use of** Virtualization and parallel processing on guest and host OS for performing different tasks by installing virtual machines.	Apply
CO 2	**Develop** Mapper and Reducer on simple applications by using Apache Hadoop on single node setup installation.	Apply
CO 3	**Construct** simple applications on services rendered by Amazon Web Service Cloud Service Provider.	Apply
CO 4	**Build** simple applications on services rendered by Google Service Provider.	Apply
CO 5	**Utilize** simple applications on services rendered by Microsoft Azure cloud Service Provider.	Apply
CO 6	**Develop** web based App by using Yahoo! pipes.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / SEE/ Lab Exercises
PO 2	**Problem analysis** analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE / SEE/ Lab Exercises
PO 3	**Successful Career and Entrepreneurship:** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry	1	CIE / SEE/ Lab Exercises
PO 4	**Conduct Investigations of Complex Problems** Practical research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	CIE / SEE/ Lab Exercises
PO 5	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	1	CIE / SEE/ Lab Exercises
PO 10	**Communication** Practical engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	CIE / SEE/ Lab Exercises
PO 12	**Life-Long Learning** Practical Experince to have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	3	CIE / SEE/ Lab Exercises

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	3	CIE / SEE/ Lab Exercises
PSO 2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	2	CIE / SEE/ Lab Exercises
PSO 3	**Successful Career and Entrepreneurship:** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry	3	CIE / SEE/ Lab Exercises

3 = High; 2 = Medium; 1 = Low

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	-	4	-	-	-	-	3
CO 2	3	5	-	4	1	-	-	-	-	2	-	3	2	-	2
CO 3	2	2	5	7	-	-	-	-	-	4	-	6	2	2	2
CO 4	2	5	3	4	-	-	-	-	-	-	-	-	-	2	2
CO 5	3	3	-	-	-	-	-	-	-	3	-	6	2	-	1
CO 6	3	3	-	-	-	-	-	-	-	3	-	6	2	-	2

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Illustrate the principles of the Digital Image Processing terminology . **Knowledge**for understanding image and its representation, pixel, intensity, gray level, relationship between the pixels by applying the principles of**engineering science to complex engineering problems** .	2
	PO 10	**Effective presentation and Speaking Style on**sampling and quantization and **write Subject Matter Effectively**the difference between analog and digital images.	4
	PSO 3	**Effective presentation and Speaking Style on**sampling and quantization and **write Subject Matter Effectively**the difference between analog and digital images.	4
CO 2	PO 1	**Develop a image with various** image transform properties types and its types using **Scientific principles and methodology fundamental mathematics.**	3
	PO 2	**Formulate and analyze (Problem analysis) complex Engineering problems** for image transforms using **first principles of mathematics and Engineering sciences.** .	3
	PO 4	**Conduct Investigations of Complex Problems** for research-based knowledge and research methods including design of experiments **to provide valid conclusions.**	3
	PO 5	**Modern Tool Usage**for modern Engineering and IT tools including prediction and modelling **understanding of the limitations**	3
	PO 10	**Effective presentation and Speaking Style on**properties of transforms and **write Subject Matter Effectively** on types of transforms.	4
	PO 12	**Life-Long Learning** forpreparation and ability to engage in independent and life-long learning in the broadest context of technological change **first principles of mathematics and Engineering sciences.** .	3
	PSO 1	**Build Skills to develop** Use real time data to implement machine learning basics with R programming **on image transforms with project development and execution process of** modern tools such as MATLAB with image processing tool box, python, CV2.	2
	PSO 3	**Build Skills to develop** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will **equip to secure and succeed in first job upon graduation in IT industry** modern tools such as MATLAB with image processing tool box, python, CV2.	2

CO 3	PO 1	**Illustrate the principles of an image find by**using engineering techniques for image enhancement by using mathematical methods.	2
	PO 2	**Illustrate** the filter processing **model translation** for spatial domain and **formulate**the time domain filter	2
	PO 3	**Develop** a histogram techniques **complex engineering problem with appropriate considerations and environmental considerations** for image enhancement	2
	PO 4	**Demonstrate** the Use image enhancement **enhancement analyze and interpretation and Ability to apply quantitative methods** for image enhancement in frequency domain processing technique to provide valid digital image	7
	PO 10	**Effective presentation and Speaking Style** on histogram processing **Write Subject Matter Effectively**on manipulation technique of an digital image	4
	PO 12	**Recognize the need for** the image segmentation in different image applications and **ability to improve**the enhancement algorithms in the broadest context of**technological advancements**	6
	PSO 1	**Build Skills to develop**on image transforms with project development and execution process of **of modern tools such as MATLAB with image processing tool box, python, CV2.** .	6
	PSO 2	**Build Skills to develop**on image transforms with project development and execution process of **of modern tools such as MATLAB with image processing tool box, python, CV2.** .	6
	PSO 3	**Build Skills to develop** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will **equip to secure and succeed in first job upon graduation in IT industry** modern tools such as AWS Service Provider.	2
CO 4	PO 1	Distinguish the Edge detection technique of image processing and us identifying **Knowledge**the points in a digital image by applying the principles of mathematics, engineering science for complex engineering problems	2
	PO 2	Formulate and analyze **Problem analysis.**complex Engineering problems Edge detection**using first principles of mathematics and Engineering sciences**	5
	PO 3	**Develop the Edge detection technique** complex engineering problem **with appropriate considerations and environmental considerations Edge detection**	3
	PO 4	Understand the Edge detection technique of image processing and us identifying **Knowledge the points in a digital image by applying the principles of (mathematics, engineering science for complex engineering problems.**	4

	PSO 2	**Build Skills to develop**on image transforms with project development and execution process of **of modern tools such as MATLAB with image processing tool box, python, CV2.** .	6
	PSO 3	**Build Skills to develop** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will **equip to secure and succeed in first job upon graduation in IT industry** modern tools such as AWS Service Provider.	2
CO 5	PO 1	Interpret frequency domain using various transforms to **apply Mathematical principles fundamental mathematics**.	3
	PO 2	**Apply Problem statement**the images in the frequency domain using various transforms techniques **by using principles of mathematics and formulate segmentation techniques.**.	3
	PO 10	**Effective presentation and Speaking Style and write on** frequency domain techniques	3
	PO 12	**Recognize** the need for frequency domain technique, and broadest context of technological change in digital	6
	PSO 1	**Build Skills to develop** with project development and execution frequency domain with modern tools such as tools such as MATLAB with image processing tool box, python, CV2	2
	PSO 3	**Build Skills to develop** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will **equip to secure and succeed in first job upon graduation in IT industry** modern tools such as AWS Service Provider.	2
CO 6	PO 1	Interpret frequency domainusing Recognize speech from audio data using different APIs signa to **apply Mathematical principles fundamental mathematics**	3
	PO 2	**Apply Problem statement** the images in frequency domain using Recognize speech from audio data using different APIs signal by using principles of mathematics frequency domain techniques	3
	PO 10	**Effective presentation and Speaking Style and write on** frequency domain using Recognize speech from audio data using different APIs signal.	3
	PO 12	**Recognize** the need for frequency domain technique, and broadest context of technological change in digital image and advanced engineering concepts	6
	PSO 1	**Build Skills to develop**with project development and execution frequency domain with modern tools such as MATLAB with image processing tool box, python, CV2	2

	PSO 3	**Build Skills to develop** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will **equip to secure and succeed in first job upon graduation in IT industry** modern tools such as AWS Service Provider.	2

XV SYLLABUS:

WEEK I	**VIRTUALIZATION**
	Install Oracle Virtual box and create two VMs on your laptop.
WEEK II	**VIRTUALIZATION**
	Install Turbo C in guest OS and execute C program.
WEEK III	**VIRTUALIZATION**
	Test ping command to test the communication between the guest OS and Host OS.
WEEK IV	**HADOOP**
	Install Hadoop single node setup.
WEEK V	**HADOOP**
	Develop a simple hadoop application called Word Count. It counts the number of occurrences of each word in a given input set.
WEEK VI	**HADOOP**
	Develop hadoop application to count no of characters, no of words and each character frequency.
WEEK VII	**HADOOP**
	Develop hadoop application to process given data and produce results such as finding the year of maximum usage, year of minimum usage.
WEEK VIII	**HADOOP**
	Develop hadoop application to process given data and produce results such as how many female and male students in both schools the results should be in following format. GP-F #number GP-M #numbers MS-F #number MS-M #number
WEEK IX	**CLOUD PROGRAMMING**
	Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
WEEK X	**CLOUD PROGRAMMING**
	Design a protocol and use Simple Queue Service(SQS)to implement the barrier synchronization after the first phase.
WEEK XI	**CLOUD PROGRAMMING**
	Use the Zookeeper to implement the coordination model in Problem 10.
WEEK XII	**CLOUD PROGRAMMING**
	Develop a Hello World application using Google App Engine

WEEK XIII	**CLOUD PROGRAMMING**
	Develop a Guestbook Application using Google App Engine.
WEEK XIV	**WINDOWS AZURE**
	Develop a Windows Azure Hello World application using.
WEEK XV	**PIPES**
	Create a Mashup using Yahoo! Pipes.

TEXTBOOKS

1. Dan Marinescu,"CLOUD COMPUTING":Theory and Practice",M.K.Publications,1st Edition2013.

REFERENCE BOOKS:

1. Dan Marinescu, —Cloud Computing: Theory and Practice‖, M K Publishers, 1st Edition, 2013.
2. Kai Hwang, Jack Dongarra, Geoffrey Foxr, —Distributed and Cloud Computing, FromParallel Processing to the Internet of Things‖, M K Publishers, 1st Edition, 2013.
3. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, —Cloud Computing: A Practical Approach‖, McGraw Hill,, 1st Edition, 2009.
4. Arshdeep Bahga, Vijay Madisetti, —Distributed and Cloud Computing, Cloud computing A Hands on Approach‖, Universities Publications, 1st Edition, 2013.

WEB REFERENCE :

1. https://nptel.ac.in/courses/106/105/106105032/
2. https://sisu.ut.ee/imageprocessing/documents
3. https://www.geeksforgeeks.org/reading-image-opencv-using-python/
4. https://tinyurl.com/yjcmyrcd
5. http://www.speech.cs.cmu.edu/15-492/

XVI COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Install Virtual Machine on Guest and Host OS	CO1	T1:4.9,R1:4.7
2	Single node set up Installation	CO2	T1:4.9,R1:4.7
3	Simple applications on services rendered by Amazon Web Service Cloud Service Provider.	CO3	T1:3.6
4	Simple applications on services rendered by Google Service Provider.	CO4	T1:3.6
5	Simple applications on services rendered by Microsoft Azure cloud Service Provider.	CO5	T1:3.6
6	Web based App by using Yahoo! pipes	CO6	T1:3.6

7	Develop hadoop application to process given data and produce results such as finding the year of maximum usage, year of minimum usage	CO2	T1:4.8,R2:4.6
8	Develop hadoop application to process given data and produce results such as how many female and male students in both schools	CO3	T1:3.6,R3:3.7
9	Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.	CO4	T1:5.9,R4:2.7
10	Design a protocol and use Simple Queue Service(SQS)to implement the barrier synchronization after the first phase.	CO2	T1:3.9,R3:2.7
11	Use the Zookeeper to implement the coordination model in Problem 10.	CO6	T1:7.9,R1:3.7
12	Develop a Hello World application using Google App Enginee	CO5	T1:2.6,R2:4.7
13	Develop a Guestbook Application using Google App Engine.	CO4	T1:3.9,R4:4.7
14	Develop a Windows Azure Hello World application using.	CO3	T1:9.2,R3:5.7
15	Create a Mashup using Yahoo! Pipes.	CO2	T1:4.9,R2:5.6

XVII EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Install Hadoop in semi-distributed environment.
2	ERP solutions using Google Cloud Service Provider.
3	CRMsolutions using Amazon Web Service Provider.

Signature of Course Coordinator **HOD,CSE**
Mr.P.Suresh Kumar, Assistant Professor