INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Accredited by NBA | Affiliated to JNTUH)

Dundigal, Hyderabad - 500 043, Telangana

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM

MASTER OF TECHNOLOGY
COMPUTER SCIENCE AND ENGINEERING

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI UNDER AUTONOMOUS STATUS

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2016 - 17)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

CONTENTS

"Take up one idea.
Make that one idea you're life-think of it, dream of it, and live on that idea.
Let the brain muscles, nerves, every part of your body be full of that idea
and just leave every other idea alone.
This is the way to success"   **Swami Vivekananda**

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two consecutive semesters i.e., Even and Odd semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

Betterment: Betterment is a way that contributes towards improvement of the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updating in respect of all the programs offered by a department.

Certificate course: It is a course that makes a student gain hands-on experience and skill required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards internal assessment.

Course: A course is a subject offered by the University for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed upto two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources and processes for evaluating the attainment of Program Educational Objectives.

Degree with Specialization: A student who fulfills all the program requirements of her/his discipline and successfully completes a specified set of professional elective courses in a specialized area is eligible to receive a degree with specialization like Structural Engineering, Embedded Systems, CSE, etc.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Detention in a course: Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

Dropping from the Semester: A student who doesn't want to register for any semester, can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 point scale.

Institute: Means Institute of Aeronautical Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Master of Technology (M.Tech) degree program / UG degree program: B.Tech.

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her second year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all M.Tech programs offered by Institute are designated as "IARE-R16" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of the odd or even semester (deadlines are different for summer sessions). However s/he can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

Words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers' also.

FOREWORD

The autonomy is conferred to Institute of Aeronautical Engineering (IARE), Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Hyderabad (JNTUH), Hyderabad and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the institute. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system** and **monitoring mechanism**, independent of the affiliating University but under its observance.

IARE is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the institute, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the institute and brighter prospects of engineering graduates.

PRINCIPAL

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

ACADEMIC REGULATIONS

M.Tech. Regular Two Year Degree Program
(for the batches admitted from the academic year 2016 - 17)

For pursuing two year postgraduate Master Degree program of study in Engineering (M.Tech) offered by Institute of Aeronautical Engineering under Autonomous status and herein after referred to as IARE.

1.0   CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work / comprehensive examination / viva / seminars / assignments / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

1. Choose electives from a wide range of elective courses offered by the departments of the Institute.
2. Undergo additional courses of interest.
3. Adopt an inter-disciplinary approach in learning.
4. Make the best use of expertise of the available faculty.

2.0   MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course curriculum in accordance with the prescribed syllabi.

3.0 ELIGIBILITY FOR ADMISSION

The admissions for category A and B seats shall be as per the guidelines of Telangana State Council for Higher Education (TSCHE) in consonance with government reservation policy.

a) Under Category A: 70% of the seats are filled based on GATE/PGECET ranks.

b) Under Category B: 30% seats are filled on merit basis as per guidelines of TSCHE.

4.0 UNIQUE COURSE IDENTIFICATION CODE

Every specialization of the M.Tech programme will be placed in one of the seven groups as listed in the Table 1.

Table 1: Group of Courses

S. No	Specialization	Offering Department	Code
1	Structural Engineering	Civil Engineering	ST
2	Power Electronics and Electrical Drives	Electrical and Electronics Engineering	PE
3	CAD / CAM	Mechanical Engineering	CC
4	Embedded Systems	Electronics and Communication Engineering	ES
5	Computer Science and Engineering	Computer Science and Engineering	CS
6	Software Engineering		SE
7	Aerospace Engineering	Aeronautical Engineering	AE

5.0 TYPES OF COURSES

Courses in a programme may be of two kinds: **Core and Elective.**

5.1 Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in said discipline of study.

5.2 Elective Course:

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study

- Providing an expanded scope

- Enabling an exposure to some other discipline/domain

- Nurturing student's proficiency/skill.

An elective may be discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from supportive/general discipline called as "Open Elective".

There shall be four professional elective groups out of which students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses which suit their project work in consultation with the faculty advisor/mentor. In addition, one

course from each of the two open electives has to be selected. A student may also opt for more elective courses in his/her area of interest.

6.0   SEMESTER STRUCTURE

The institute shall follow semester pattern. An academic year shall consist of a first semester and a second semester and the summer term. Each semester shall be of 23 weeks (Table 2) duration and this period includes time for course work, examination preparation and conduct of examinations. Each main semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical shall be 75 and 15 days shall be for examination preparation. The duration for each semester shall be a minimum of 17 weeks of instruction. The Academic Calendar is declared at the beginning of the academic year as given in Table 2.

Table 2: Academic Calendar

FIRST SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation and Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Exams			2 weeks
SECOND SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 Week	
	Preparation & Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Summer Vacation			4 weeks
THIRD SEMESTER	Project Work Phase - I		18 weeks
FOURTH SEMESTER	Project Work Phase - II		18 weeks

7.0   PROGRAM DURATION

A student shall be declared eligible for the award of M.Tech degree, if s/he pursues a course of study and completes it successfully in not less than two academic years and not more than four academic years. A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her seat in M.Tech course.

a) A student will be eligible for the award of M.Tech degree on securing a minimum of 5.0/10.0 CGPA.

b) In the event of non-completion of project work and/or non-submission of the project report by the end of the fourth semester, the candidate shall re-register by paying the semester fee for the project. In such a case, the candidate will not be permitted to submit the report earlier than three months and not later than six months from the date of registration.

8.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Core Courses, Elective Courses, Laboratory Course, Comprehensive Examination, Internship and Project Work. The list of elective courses may include subjects from allied disciplines also.

Each Theory and Laboratory course carries credits based on the number of hours/week as follows:

- **Lecture Hours (Theory):** 1 credit per lecture hour per week.

- **Laboratory Hours (Practical):** 1 credit for 2 practical hours, 2 credits for 3 or 4 practical hours per week.

- **Project Work:** 1 credit for 4 hours of project work per week.

8.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Core Courses	3	3
2	Elective Courses	3	3
3	MOOC Courses	-	2
4	Laboratory Courses	3	2
5	Seminar and Technical Writing	3	2
6	Comprehensive Examination	-	2
7	Project Work	128	30

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Core Courses (06) + Professional Electives (04) + Open Electives (02)	06 @ 3 credits + 06 @ 3 credits	36
Total Laboratory Courses (03)	03 @ 2 credits	06
MOOC Courses (02)	02 @ 2 credits	04
Seminar and Technical Writing (01)	1 @ 2 credits	02
Comprehensive Examination (01)	1 @ 2 credits	02
Project Work	1 @ 30 credits	30
TOTAL CREDITS		**80**

9.0 EVALUATION METHODOLOGY

9.1 Theory Course:

Each theory 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 CIE during the semester, marks are awarded by taking average of two sessional examinations.

9.1.1 Semester End Examination (SEE):

The SEE shall be conducted for 70 marks of 3 hours duration. The syllabus for the theory courses shall be divided into FIVE units and each unit carries equal weightage in terms of marks distribution. The question paper pattern shall be as defined below. Two full questions with 'either' 'or' choice will be drawn from each unit. Each question carries 14 marks. There could be a maximum of three sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

9.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty/teacher handling the course as given in Table 4. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Technical Seminar and Term Paper.

Table 4: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE Exam (Sessional)	Technical Seminar and Term Paper	
Max. CIA	25	5	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration, consisting of 5 one mark compulsory questions in part-A and 4 questions in part-B. The student has to answer any 4 questions out of five questions, each carrying 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Technical Seminar and Term Paper:

Two seminar presentations are conducted during I year I semester and II semester. For seminar, a student under the supervision of a concerned faculty member, shall identify a topic in each course and prepare the term paper with overview of topic. The evaluation of Technical seminar and term paper is for maximum of 5 marks. Marks are awarded by taking average of marks scored in two Seminar Evaluations.

9.2 Laboratory Course:

9.2.1 Each lab 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. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

9.2.2 All the drawing related courses are evaluated in line with lab courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test for 10 marks each in a semester.

9.3 MOOC Courses:

Meeting with the global requirements, to inculcate the habit of self learning and in compliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives.

9.3.1 The proposed MOOC Courses would be additional choices in all the elective groups subject to the availability during the respective semesters and respective departments will declare the list of the courses at the beginning of the semester. Course content for the selected MOOC Courses shall be drawn from respective MOOCs links or shall be supplied by the department. Course will be mentored by faculty members and Assessment and evaluation of the courses shall be done by the department.

9.3.2 There shall be one Mid Sessional Examination (Quiz exam for 30 marks) after 8 weeks of the commencement of the course and semester end evaluation (Descriptive exam for 70 marks) shall be done along with other regular courses.

9.3.3 Two credits will be awarded upon successful completion of each MOOC Course.

9.3.4 Students interested in doing MOOC Courses shall register the course title at their department office at the start of the semester against the courses that are announced by the department.

9.4 Project work

Normally, the project work should be carried out at Host Institute (Institute of Aeronautical Engineering). However, it can also be carried out in any of the recognized Educational Institutions, National Laboratories, Research Institutions, Industrial Organizations, Service Organizations or Government Organizations with the prior permission from the guide and concerned Head of the Department. A student shall submit the outcome of the project work in the form of a dissertation.

9.4.1 The student shall submit the project work synopsis at the end of III semester for Phase-I of project evaluation. The Phase-I of project work shall be evaluated by Project Review Committee (PRC) at the end of the third semester for a maximum of 100 marks. Head of the Department (HOD) shall constitute a PRC comprising of senior faculty of the specialization, Guide and Head of the Department.

9.4.2 The first phase of project work is to be carried out in IV semester for Phase –II of Project work. The student will be allowed to appear for final viva voce examination at the end of IV semester only if s/he has submitted s/he project work in the form of paper for

presentation / publication in a conference/journal and produce the proof of acceptance of the paper from the organizers/publishers.

9.4.3 The student shall submit the project work in the form of dissertation at least four weeks ahead of the completion of the program. Head of the Department shall constitute an Internal Evaluation Committee (IEC) comprising of the Chairman BOS (PG), HOD and Guide. As per convenes of all meeting for open pre-submission seminar evaluation of the student. If the open pre-submission seminar by a student is not satisfactory, another seminar shall be scheduled within two weeks.

The evaluation of the project work and the marks allotted are as under:

S.No	Project Phases	Mode	Evaluation Committee	Marks
1	Phase - I	Continuous evaluation at the end of III Semester	Guide	30
2		Evaluation at the end of III Semester	Project Review Committee (PRC) comprising of senior faculty of the specialization, guide and HOD.	70
Total(Phase – I)				100
3	Phase - II	An open pre-submission seminar by the student	The Internal Evaluation Committee (IEC) comprising of the Chairman, BOS (PG), HOD and guide wherein the HOD convenes its meeting.	30
4		End Semester Examination (An open seminar followed by viva-voce)	The External Evaluation Committee (EEC) comprising of External Examiner, HOD and guide wherein the HOD shall be the chairman of the committee.	70
Total(Phase-II)				100

9.4.4 As soon as a student submits his project work, Principal shall appoint the External Examiner among the panel of examiners recommended by the Chairman, BOS (PG).

9.4.5 The Principal shall schedule the End Semester Examination in project work soon after the completion of the study of program and a student can appear for the same provided s/he has earned successfully all the requisite credits. The student shall produce the dissertation duly certified by the guide and HOD during the Examination.

9.4.6 The project reports of M. Tech students who have not completed their course work successfully will be evaluated in that semester itself and the result sent confidentially to the Controller of Examinations. The results of the project work evaluation will be declared by the Controller of Examinations only after the successful completion of the courses by those students.

9.5 Comprehensive Examination

The comprehensive examination is aimed at assessing the student's understanding of various Foundation, Skill and Core courses studied by the end of II semester and is intended to test the student's grasp of the chosen field of study. The comprehensive examination is an online test evaluated for 100 marks.

10.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

10.1   It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 80% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

10.2   For cases of medical issues, deficiency of attendance in each course to the extent of 15% may be condoned by the Institute Academic Committee (CAC) on the recommendation of Head of the Department if his/her attendance is between 80% to 70% in every course, subjected to submission of medical certificate and other needful documents to the concerned department.

10.3   The basis for the calculation of the attendance shall be the period prescribed by the institute by its calendar of events. For late admission, attendance is reckoned from the date of admission to the program.

10.3   However, in case of a student having less than 70% attendance in any course, s/he shall be detained in the course and in no case such process will be relaxed.

10.4   Students whose shortage of attendance is not condoned in any subject are not eligible to write their semester end examination of that courses and their registration shall stand cancelled.

10.5   A prescribed fee shall be payable towards Condonation of shortage of attendance.

10.6   A candidate shall put in a minimum required attendance at least in three (3) theory courses for getting promoted to next higher class / semester. Otherwise, s/he shall be declared detained and has to repeat semester.

10.7   A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, s/he shall not be eligible for readmission into the same class.

11.0   CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

11.1   Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

11.2   Question papers may be moderated for the coverage of syllabus, pattern of questions by Semester End Examination Committee chaired by Head of the Department one day before the commencement of semester end examinations.

11.3   Internal Examiner shall prepare a detailed scheme of valuation.

11.4   The answer papers of semester end examination should be evaluated by the internal examiner immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover before the same papers are kept for second evaluation by external examiner.

11.5   In case of difference is more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and marks awarded by him shall be taken as final.

11.6   HOD shall invite 3-9 external examiners to evaluate all the end semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted involving external examiners.

11.7 Examination Control Committee shall consolidate the marks awarded by internal and external examiners to award grades.

12.0   SCHEME FOR THE AWARD OF GRADE

12.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures:

   i.   Not less than 40% marks for each theory course in the semester end examination, and

   ii. A minimum of 50% marks for each theory course considering both CIA and SEE

12.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Laboratory / Seminar and Technical Writing / Project, if s/he secures

   i.   Not less than 40% marks for each Laboratory / Seminar and Technical Writing / Project course in the semester end examination,

   ii. A minimum of 50% marks for each Laboratory / Seminar and Technical Writing / Project course considering both internal and semester end examination.

12.3 If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

13.0   LETTER GRADES AND GRADE POINTS

13.1   Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10 point grading system with the following letter grades as given below:

Range of Marks	Grade Point	Letter Grade
90 - 100	10	S (Superior)
80 – 89	9	A+ (Excellent)
70 – 79	8	A (Very Good)
60 – 69	7	B+ (Good)
55 – 59	6	B (Average)
50 - 54	5	P (Pass)
Below 50	0	F (Fail)
Absent	0	Ab (Absent)
Authorized Break of Study	0	ABS

13.2   A student obtaining Grade F shall be declared as failed and will be required to reappear in the examination.

13.3   At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

14.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n} (C_i \, G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course and n represent the number of courses in which a students is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m} (C_j \, S_j) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the jth semester and C_j is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	O	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

Thus, SGPA = 139 / 20 = 6.95

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20	Credit: 22	Credit: 25	Credit: 26
SGPA: 6.9	SGPA: 7.8	SGPA: 5.6	SGPA: 6.0

$$Thus, \; CGPA = \frac{20x6.9 + 22x7.8 + 25x5.6 + 26x6.0}{93} = 6.51$$

16.0   PHOTOCOPY / REVALUATION

A student, who seeks the revaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s) within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the Department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

17.0   GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of M .Tech degree.

17.1   Student shall register and acquire minimum attendance in all courses and secure 80 credits.

17.2   A student who fails to earn 80 credits within four consecutive academic years from the year of his/her admission with a minimum CGPA of 5.0, shall forfeit his/her degree and his/her admission stands cancelled.

18.0   AWARD OF DEGREE

Classification of degree will be as follows:

$CGPA \geq 7.5$	$CGPA \geq 6.5$ and < 7.5	$CGPA \geq 5.5$ and < 6.5	$CGPA \geq 5.0$ and < 5.5	$CGPA < 5.0$
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

a)   In case a student takes more than one attempt in clearing a course, the final marks secured shall be indicated by * mark in the grade sheet.

b)   All the candidates who register for the semester end examination will be issued grade sheet by the Institute. Apart from the semester wise grade sheet, the institute will issue the provisional certificate subject to the fulfillment of all the academic requirements.

19.0   IMPROVEMENT OF GRADE:

A candidate, after becoming eligible for the award of the degree, may reappear for the final examination in any of the theory courses as and when conducted for the purpose of improving the aggregate and the grade. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the degree.

However, this facility shall not be availed of by a candidate who has taken the Original Degree Certificate. Candidates shall not be permitted to reappear either for CIE in any course or for Semester End Examination (SEE) in laboratory courses (including Project Viva-voce) for the purpose of improvement.

20.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student may be asked to leave the institute in the following circumstances:

a) The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

b) The student fails to satisfy the norms of discipline specified by the institute from time to time.

21.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the institute / if any case of indiscipline / malpractice is pending against him/her, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

22.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute.

The institute shall institute prizes and medals to meritorious students annually on Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

23.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

24.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievances related to the course under consideration.

25.0 TRANSITORY REGULATIONS

25.1   A student who has been detained in any semester of previous regulations for not satisfying the attendance requirements shall be permitted to join in the corresponding semester of this regulation.

25.2   Semester End Examination in each course under the regulations that precede immediately these regulations shall be conducted three times after the conduct of last regular examination under those regulations. Thereafter, the failed students, if any, shall take examination in the equivalent papers of these regulations as suggested by the Chairman, BOS concerned.

26.0   REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

**FAILURE TO READ AND UNDERSTAND
THE REGULATIONS IS NOT AN EXCUSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

COMPUTER SCIENCE AND ENGINEERING
COURSE STRUCTURE

I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BCS001	Foundations of Data Science	PC	Core	3	-	-	3	30	70	100
BCS002	Data Structures and Problem Solving	PC	Core	3	-	-	3	30	70	100
BCS003	High Performance Architecture	PC	Core	3	-	-	3	30	70	100
	Professional Elective - I	PE	Elective	3	-	-	3	30	70	100
	Professional Elective - II	PE	Elective	3	-	-	3	30	70	100
	Open Elective – I	OE	Elective	3	-	-	3	30	70	100
BCS301	MOOC – I (Massive Open Online Course)	PE	Elective	-	-	3	2	30	70	100
PRACTICAL										
BCS101	Data Science Laboratory	PC	Core	-	-	3	2	30	70	100
TOTAL				18	00	06	22	240	560	800

II SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BCS004	Distributed Operated System	PC	Core	3	-	-	3	30	70	100
BCS005	Advanced Database Management System	PC	Core	3	-	-	3	30	70	100
BCS006	Cyber Security	PC	Core	3	-	-	3	30	70	100
	Professional Elective -III	PE	Elective	3	-	-	3	30	70	100
	Professional Elective -IV	PE	Elective	3	-	-	3	30	70	100
	Open Elective -II	OE	Elective	3	-	-	3	30	70	100
PRACTICAL										
BCS102	Distributed Operating Systems Laboratory	PC	Core	-	-	3	2	30	70	100
BCS103	Application Development Mini Project Laboratory	-	Core	-	-	3	2	30	70	100
TOTAL				18	00	06	22	240	560	800

III SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BCS401	Seminar and Technical Writing	PC	Core	-	-	3	2	30	70	100
BCS302	MOOC- II (Massive Open Online Course)	PE	Elective	-	-	3	2	30	70	100
PRACTICAL										
BCS501	Comprehensive Examination	-	Core	-	-	-	2	30	70	100
BCS601	Project Work(Phase -I)	-	Core	-	-	-	10	100	-	100
TOTAL				00	00	06	16	190	210	400

IV SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
BCS602	Project Work(Phase -II)	-	Core	-	-	-	20	30	70	100
TOTAL				00	00	00	20	30	70	100

PROFESSIONAL ELECTIVES

GROUP -1: DATABASES AND INFORMATION SYSTEMS

Course Code	Course Title
BSE004	Software Defined Networks
BCS201	Web Intelligent and Algorithm
BCS202	Optimization Techniques
BCS203	Enterprise Wide Information Systems

GROUP- 2: WEB TECHNOLOGY AND NETWORK SECURITY

Course Code	Course Title
BCS204	Advanced Web Technologies
BCS205	Wireless Communications and Networks
BCS206	Android Application Development
BCS207	Internet of Things

GROUP 3: COGNITIVE COMPUTING

Course Code	Course Title
BCS208	Soft Computing
BCS209	Natural Language Processing
BCS210	Cluster and Grid Computing
BCS211	Computer Vision

GROUP 4: CLOUD AND BIGDATA

Course Code	Course Title
BCS212	Big Data Analytics
BCS213	Business Intelligence
BCS214	Knowledge Based Systems
BCS215	Cloud Infrastructure and Services

OPEN ELECTIVES-I

Course Code	Course Title
BST701	Disaster Management
BPE701	Renewable Energy Sources
BCC701	Automotive Design
BES001	Embedded C
BCS701	Advanced JAVA Programming and Web Services*
BAE701	Introduction to Aerospace Engineering
Note: * indicates that subject not offered to the students of Computer Science and Engineering Department	

OPEN ELECTIVES-II

Course Code	Course Title
BST701	Geo Spatial Techniques
BPE702	Solar Photo Voltaic Energy Conversion
BCC702	Computer Graphics
BES702	Microcontrollers for Embedded System Design
BCS702	Linux Programming*
BCS703	Research Methodology
BAE702	Industrial Aerodynamics and Wind Energy
Note: * indicates that subject not offered to the students of Computer Science and Engineering Department	

SYLLABI

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS001	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:
The course should enable the students to:
I.   Summarize the fundamental knowledge on basics of data science and R programming.
II. Develop programs in R language for understanding and visualization of data using statistical functions and plots.
III. Learn to apply hypotheses and data into actionable predictions.
IV. Understand a range of machine learning algorithms along with their strengths and weaknesses.
V.   Able to document and transfer the results and effectively communicate the findings using visualization techniques.

UNIT-I	INTRODUCTION	Classes: 10

Data science process, roles, stages in data science project, working with data from files, working with relational databases, exploring data, managing data, cleaning and sampling for modeling; Introduction to R: Introduction to various data types, numeric, character, date, data frame, array, matrix etc., reading and writing datasets, working with different file types .txt, .csv, outliers, R functions and loops; Summary statistics: Summary, str, aggregate, subset, head, tail; Probability distribution.

UNIT-II	SQL, NOSQL AND DATA ANALYSIS	Classes: 10

SQL using R, excel and R, introduction to NoSQL, connecting R to NoSQL databases, R with XML, JSON; Correlation analysis; Covariance analysis, ANOVA, forecasting, heteroscedasticity, autocorrelation; Regression analysis: Regression modeling, multiple regression.

UNIT-III	DATA MODELS	Classes: 08

Choosing and evaluating models, mapping problems to machine learning, evaluating clustering models, validating models.

Cluster analysis: K-means algorithm, Naive Bayes memorization methods, unsupervised methods.

UNIT-IV	ARTIFICIAL NEURAL NETWORKS	Classes: 09

Artificial neural networks: Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back propagation algorithm, remarks on the back propagation algorithm; Evaluation hypotheses: Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT-V	DELIVERING RESULTS	Classes: 08

Documentation and deployment, producing effective presentations, introduction to graphical analysis, plot() function, displaying multivariate data, matrix plots, multiple plots in one window, exporting graph, using graphics parameters, case studies.

Text Books:

1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 1st Edition, 2014.
2. William N. Venables, David M. Smith, "An Introduction to R", Network Theory Limited, 2nd Edition, 2009.
3. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Taylor & Francis CRC Press, 2nd Edition, 2011.

Reference Books:

1. G. Jay Kerns, "Introduction to Probability and Statistics Using R", Youngstown State University, USA, 1st Edition, 2011.
2. William W Hsieh, "Machine Learning Methods in the Environmental Sciences", Neural Networks, Cambridge University Press, 1st Edition, 2009.
3. Chris Bishop, "Neural Networks for Pattern Recognition", Oxford University Press, 1st Edition, 1995.
4. Peter Flach, "Machine Learning", Cambridge University Press, 1st Edition, 2012.

Web References:

1. http://www.tutorialspoint.com/r/
2. https://en.wikipedia.org/wiki/R_programming_language.
3. http://www.r-bloggers.com/how-to-learn-r-2/#h.obx6jyuc9j7t.

E-Text Books:

1. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
2. https://www.cs.bris.ac.uk/~flach/mlbook/.
3. http://mylovelibrabry.com/emylibraryus/free.php?asin=1466583282.

DATA STRUCTURES AND PROBLEM SOLVING

I Semester: CSE / SE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCS002	**Core**	3	-	-	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:
The course should enable the students to :
I. Understand the data structures and techniques of algorithm analysis.
II. Solve problems using different data structures and compare their performance and tradeoffs.
III. Illustrate the implementation of linked data structures such as linked lists and binary trees.
IV. Understand graph algorithms such as shortest path and minimum spanning tree.
V. Learn advanced data structures such as balanced search trees, hash tables, priority queues

UNIT-I	OVERVIEW OF DATA STRUCTURES	Classes: 09

Algorithm analysis: Algorithms; Performance analysis: Time complexity and space complexity, asymptotic notation: Big Oh, omega and theta notations, complexity analysis examples; Data structures: Linear and non linear data structures, ADT concept, linear list ADT, stack and queue ADTs, array and linked list representations; Circular queue: Insertion and deletion, de queue ADT, priority queue ADT, implementation using heaps, insertion into a max heap, deletion from a max heap, singly linked lists, doubly linked lists, circular linked list.

UNIT-II	DICTIONARIES, HASH TABLES	Classes: 09

Dictionaries: Linear list representation, operations insertion, deletion and searching, hash table representation, hash functions, collision resolution, separate chaining, open addressing, linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

UNIT-III	TREES AND GRAPHS	Classes: 09

Trees: Ordinary and binary trees terminology, properties of binary trees, binary tree ADT, representations, recursive and non recursive traversals, threaded binary trees.

Graphs: Graphs terminology, graph ADT, representations, graph traversals; Search methods: DFS and BFS; Applications of Graphs: Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for single source shortest path problem.

UNIT-IV	SEARCH TREES I	Classes: 09

Binary search tree: Binary search tree ADT, insertion, deletion and searching operations, finding the parent of a given node, attaining a reference to a node, finding the smallest and largest values in the binary search tree; Balanced search trees: AVL trees, definition, height of an AVL tree; Operations : Insertion, deletion and searching.

UNIT-V	SEARCH TREES II	Classes: 09

Red-Black and Splay Trees; B trees: Definition, operations and applications; R trees: Nearest neighbor query, join and range queries; Comparison of search trees; Text compression: Huffman coding and decoding; Pattern matching: KMP algorithm.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press Private Limited, India, 2nd Edition, 2008.
2. G. A. V. Pai, "Data Structures and Algorithms", Tata Mc Graw Hill, New Delhi, 1st Edition, 2008.
3. M. A. Weiss, Addison Wesley, "Data Structures and Algorithm Analysis in Java", Pearson Education, 2nd Edition, 2005.

Reference Books:

1. D. Samanta, "Classic Data Structures", Prentice Hall of India Private Limited, 2nd Edition, 2003.
2. Aho, Hopcraft, Ullman, "Design and Analysis of Computer Algorithms", Pearson Education India,1st Edition, 1998.
3. Goodman, Hedetniemi, "Introduction to the Design and Analysis of Algorithms", Tata McGraw Hill, New Delhi, India, 1st Edition, 2002.
4. Adam Drozdek , "Data Structures and Algorithms in C++", Thomson Course Technology, 3rd Edition, 2005.
5. M. T. Goodrich, R. Tomassia, "Data structures and Algorithms in Java", Wiley India, 3rd Edition,2011.

Web References:

1. http://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.htm
2. http://www.geeksforgeeks.org/b-tree-set-1-introduction-2/
3. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

E-Text Books:

https://comsciers.files.wordpress.com/2015/12/horowitz- -of-computer-algorithms-2nd-edition.pdf

HIGH PERFORMANCE ARCHITECTURE

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS003	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:
The course should enable the students to:
  I. Understand the compiling issues for various parallel architectures.
 II. Implementation of transformation techniques for code parallelization.
III. Understand memory management and scheduling for parallel machine.

UNIT-I	**PARALLEL AND VECTOR ARCHITECTURES**	**Classes: 09**

Compiling for scalar pipeline, compiling for vector pipeline, super scaler and VLIW processors, compiling for multiple issue processors, Processor parallelism, Bernstein's conditions. The role of dependence. Dependence analysis: Concept of dependence, classification of dependences, dependence in loops, dependence distance, dependence direction, loop carried and loop independent dependences, level of loop carried dependence. Simple dependence testing, vectorization and parallelization, Preliminary transformations required to make dependence testing more accurate Loop normalization, scalar data flow analysis, induction variable substitution, scalar renaming.

UNIT-II	**DEPENDENCE TESTING**	**Classes: 09**

Dependence Testing :Introduction, Background and Terminology, Dependence Testing Overview , Subscript Partitioning , Merging Direction Vectors, Single-Subscript Dependence Tests , ZIV Test , SIV Tests , Multiple Induction-Variable Tests, Testing in Coupled Groups , The Delta Test , More Powerful Multiple-Subscript Tests, An Empirical Study , Putting It All Together.

UNIT-III	**FINE-GRAINED AND COARSE-GRAINED PARALLELISM**	**Classes: 09**

Fine-Grained parallelism. Enhancing Fine-Grained parallelism (useful in vector machines and Machines with instruction-level parallelism) using loop distribution. Use of loop interchange for vectorization, scalar and array renaming, use of loop skewing.
Coarse-Grained parallelism: Enhancing Coarse-Grained parallelism: using privatization and scalar expansion, loop alignment, loop fusion, use of loop interchange for parallelization

UNIT-IV	**HANDLING CONTROL FLOW**	**Classes: 09**

Types of branches. If- conversion. Management of Memory Hierarchy: scalar register allocation and management of the cache memory hierarchy. Topics include scalar replacement, unroll-and-jam, loop alignment, cache blocking, and perfecting.

UNIT-V	IMPROVING REGISTER USAGE	Classes: 09

Improving Register Usage :Introduction ,Scalar Register Allocation ,Data Dependence for Register Reuse , Loop-Carried and Loop-Independent Reuse ,A Register Allocation Example, Scalar Replacement ,Pruning the Dependence Graph ,Simple Replacement , Handling Loop-Carried Dependences, Dependences Spanning Multiple Iterations ,Eliminating Scalar Copies ,Loop Interchange for Register Reuse.

Text Books:

1. Allen and Kennedy, "Optimizing Compilers for Modern Architectures", Morgan-Kaufmann, 1st Edition, 2001.
2. Wolfe, High Performance Compilers for Parallel Computing, Addison-Wesley, 1st Edition, 1996.

Reference Books:

1. Banerjee, "Dependence Analysis", Kluwer Academic Publishers,1st Edition,1997.
2. Wolfe, Optimizing Super compilers for Supercomputers, MIT Press.
3. Zima and Chapman, Super compilers for Parallel and Vector Computers, ACM Press

Web References:

1. http://nptel.ac.in/courses/106104024/#
2. www.cs.technion.ac.il/~erez/courses/seminar/lectures/03a.ppt

E-Text Books:

1. https://www.amazon.com/High-performance-Architecture-Addison-Wesley-electrical-engineering/dp/0201513773
2. https://books.google.co.in/books?hl=en&lr=&id=30NNwXWvOLcC&

DATA SCIENCE LABORATORY

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS101	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	3	2	30	70	100

Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: 36**	**Total Classes: 36**

OBJECTIVES:

The course should enable the students to:

I.   Illustrate R objects.
II. Make use of different types of datasets for analysis in R.
III. Define relations among variables using correlation and covariance analysis.
IV. Analyze and differentiate the data models for predictions using R.

LIST OF EXPERIMENTS

Week-1	**R AS CALCULATOR APPLICATION**

a. Using with and without R objects on console
b. Using mathematical functions on console
c. Write an R script, to create R objects for calculator application and save in a specified location in disk

Week-2	**DESCRIPTIVE STATISTICS IN R**

a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars & cars datasets.
b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.

Week-3	**READING AND WRITING DIFFERENT TYPES OF DATASETS**

a. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location.
b. Reading Excel data sheet in R.
c. Reading XML dataset in R.

Week-4	**VISUALIZATIONS**

a. Find the data distributions using box and scatter plot.
b. Find the outliers using plot.
c. Plot the histogram, bar chart and pie chart on sample data.

Week-5	CORRELATION AND COVARIANCE

a. Find the correlation matrix.
b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

Week-6	REGRESSION MODEL

Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. require (foreign), require(MASS).

Week-7	MULTIPLE REGRESSION MODEL

Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.

Week-8	REGRESSION MODEL FOR PREDICTION

Apply regression Model techniques to predict the data on above dataset.

Week-9	CLASSIFICATION MODEL

a. Install relevant package for classification.
b. Choose classifier for classification problem.
c. Evaluate the performance of classifier.

Week-10	CLUSTERING MODEL

a. Clustering algorithms for unsupervised classification.
b. Plot the cluster data using R visualizations.

Reference Books:

Yanchang Zhao, "R and Data Mining: Examples and Case Studies", Elsevier, 1st Edition, 2012.

Web References:

1.   http://www.r-bloggers.com/how-to-perform-a-logistic-regression-in-r/
2.   http://www.ats.ucla.edu/stat/r/dae/rreg.htm
3.   http://www.coastal.edu/kingw/statistics/R-tutorials/logistic.html
4.   http://www.ats.ucla.edu/stat/r/data/binary.csv

SOFTWARE AND HARDWARE REQUIREMENTS FOR 18 STUDENTS:

SOFTWARE: R Software , R Studio Software

HARDWARE: 18 numbers of Intel Desktop Computers with 4 GB RAM

DISTRIBUTED OPERATING SYSTEM

II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS004	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:
The course should enable the students to:
I. Understand the concepts of resource sharing, multitasking, multiprocessing in distributed environment.
II. Explore on various internals of operating system.
III. Describe contrast and compare differing structures for operating systems.
IV. Understand and analyze theory and implementation of processes, resource control , physical and virtual memory, scheduling, I/O and files.

UNIT-I	INTRODUCTION	Classes: 10

Introduction: Introduction to distributed System, goals of distributed system, hardware and software concepts, design issues; Communication in distributed system: Layered protocols, ATM networks, client – server model, remote procedure calls and group communication; Middleware and Distributed Operating Systems.

UNIT-II	MUTUAL EXCLUSION AND DEADLOCK IN DISTRIBUTED SYSTEMS	Classes: 10

Synchronization in Distributed System: Clock synchronization, mutual exclusion, election algorithm, the bully algorithm, ring algorithm, atomic transactions, deadlock in distributed systems, distributed deadlock prevention, distributed deadlock detection.

UNIT-III	PROCESSES AND PROCESSORS	Classes: 08

Processes and Processors in distributed systems: Threads, System models, Processors Allocation, Scheduling in Distributed System; Real Time Distributed Systems.

Distributed file system design, distributed file system implementation, trends in distributed file systems.

UNIT-IV	DISTRIBUTED SHARED MEMORY	Classes: 09

Distributed shared memory: what is shared memory, consistency models, page based distributed shared memory, shared variables and distributed shared memory.

UNIT-V	MACH	Classes: 08

Case study MACH: Introduction to MACH, process management in MACH, communication in MACH, UNIX emulation in MACH.

Text Books:
1. Andrew S. Tanenbaum, "Distributed Operating System", PHI, 1st Edition, 1994. 2. Andrew S. Tanenbaum, , Herbert Bos "Modern Operating Systems", Pearson Higher Ed,4th Edition, 2014.

Reference Books:
1. Andrew S. Tanenbaum, Maarten van Steen, "Distributed Systems: Principles and Paradigms", Pearson Prentice Hall,2nd Edition Illustrated, 2007. 2. R. Chow and T. Johnson, "Distributed Operating Systems & Algorithms", Addison-Wesley, 1997.

Web References:
1. https://www.youtube.com/watch?v=sK9MC5GREXg 2. http://nptel.ac.in/syllabus/106106107/

E-Text Books:
1. https://www.amazon.com/Distributed-Operating-Systems-Andrew-Tanenbaum/dp/0132199084 2. https://books.google.com/books?id=wa1GAwAAQBAJ&source=gbs_similarbooks

ADVANCED DATABASE MANAGEMENT SYSTEM

II Semester: CSE | **II Group:** SE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCS005	**Core**	3	-	-	3	30	70	100

Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: 45**

OBJECTIVES:
The course should enable the students to:
I.   Design databases using data models.
II. Query and manage databases.
III. Distinguish between centralized and distributed databases.
IV. Implement applications involving complex transaction processing.
V.   Do query evaluation and query optimization.

UNIT-I	INTRODUCTION	Classes: 10

History of Data base Systems. Data base System Applications, data base System VS file System; Data Models: ER Model, relational model, other models; Database Languages: DDL, DML; Introduction to the Relational Model: Integrity constraint over relations, Enforcing integrity constraints, querying relational data, logical data base design; Introduction to Views: Destroying, altering tables and views; Introduction of object database systems: Structured data types, operations on structured data, encapsulation and ADTS, Inheritance.

UNIT-II	ORDBMS	Classes: 10

Database design for ORDBMS, ORBMS implementation and challenges, OODBMS, comparison of RDBMS, OODBMS and ORDBMS. Introduction to Parallel databases, architectures for parallel databases, Parallel Query Evaluation: Data partitioning and parallelizing sequential operator evaluation code, parallelizing individual operations, and parallel query optimization.

UNIT-III	DISTRIBUTED DATABASES	Classes: 08

Introduction to distributed databases: Features of distributed databases vs centralized databases, Why distributed databases.

DDBMS: Levels of transparency, reference architecture for DDB, types of data fragmentation, distribution transparency for read-only and update applications, distributed database access primitives, Integrity constraints in distributed databases.

UNIT-IV	DISTRIBUTED DATABASE DESIGN	Classes: 09

Distributed database design: framework for distributed database design, the design of database fragmentation, allocation of fragments; Distributed Query processing: Equivalence of transformations for queries, transforming global queries into fragment queries, distributed grouping and aggregation functions, parametric queries.

UNIT-V	QUERY OPTIMIZATION	Classes: 08

A framework for query optimization, join queries and general queries. non-join queries in a distributed DBMS, joins in a distributed DBMS, cost based query optimization. DBMS Vs IR systems, Introduction to Information retrieval, Indexing for text search, web search engine, managing text in a DBMS, a data model for XML, Querying XML data, and efficient evaluation of XML queries.

Text Books:

1. Raghuramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, TMH, 2006.
2. S Ceri and G Pelagatti, "Distributed databases principles and systems", 1st Edition, TMH, 2008.

Reference Books:

1. Silberschatz, Korth, "Database System Concepts", 6th Edition, TMH, 2010.
2. Elmasri R, Navathe S B, Somayajulu D V L N, and Gupta S K, "Fundamentals of Database Systems", 5th Edition, Pearson Education,2009.
3. C. J. Date, "Introduction to Database Systems", 8th Edition, Pearson Education, 2009.

Web References:

1. http://www.comptechdoc.org/independent/database/basicdb/dataobject.html
2. https://docs.oracle.com/cd/B28359_01/.../ds_concepts001.htm
3. https://codex.cs.yale.edu/avi/db-book/db6/slide-dir/PDF-dir/ch13.pd

E-Text Books:

1. https://pages.cs.wisc.edu/~dbbook/
2. https://www.amazon.com/Database-Management-Systems-Raghu-Ramakrishnan/dp/0072465638

CYBER SECURITY

II Semester: CSE	I Semester: SE							

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCS006	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the students to:

I. Explain the core information assurance principles.
II. Identify the key components of cyber security network architecture.
III. Apply cyber security architecture principles.
IV. Describe risk management processes and practices.

UNIT-I	INTRODUCTION	Classes: 09

A web security forensic lesson, web languages, introduction to different web attacks, overview of n-tier web applications; Web servers: Apache, IIS, database servers, introduction and overview of cyber crime, nature and scope of cyber crime, types of cyber crime: social engineering, categories of cyber crime, property cyber crime.

UNIT-II	REVIEW OF COMPUTER SECURITY AND CYBER CRIME ISSUES	Classes: 09

Public key cryptography, RSA, online shopping, payment gateways, unauthorized access to computers, computer intrusions, white collar crimes, viruses and malicious code, internet hacking and cracking, virus attacks, pornography, software piracy, intellectual property, mail bombs, exploitation, stalking and obscenity in internet, digital laws and legislation, law enforcement roles and responses.

UNIT-III	WEB HACKING BASICS AND INVESTIGATION	Classes: 09

Web hacking basics HTTP and HTTPS URL, web under the cover overview of java security reading the HTML source, applet security, servlets security, symmetric and asymmetric encryptions, network security basics, firewalls and IDS.

Investigation: Introduction to cyber crime investigation, investigation tools, e-discovery, digital evidence collection, evidence preservation, e-mail investigation, e-mail tracking, IP tracking, e-mail recovery, hands on case studies; Encryption and Decryption methods, search and seizure of computers, recovering deleted evidences, password cracking.

UNIT-IV	DIGITAL CERTIFICATES AND DIGITAL FORENSICS	Classes: 09

Digital certificates, hashing, message digest, and digital signatures; Digital forensics: Introduction to digital forensics, forensic software and hardware, analysis and advanced tools, forensic technology and practices, forensic ballistics and photography, face, iris and fingerprint recognition, audio video analysis, windows system forensics, linux system forensics, network forensics.

UNIT-V	SECURING DATABASES, LAWS AND ACTS	Classes: 09

Basics, secure JDBC, securing large applications, cyber graffiti; Laws and acts: Laws and ethics, digital evidence controls, evidence handling procedures, basics of Indian Evidence Act IPC and CrPC, electronic communication privacy act, legal policies.

Text Books:

1. Mc Clure, Stuart, Saumil Shah, Shreeraj Shah, "Web Hacking: Attacks and Defense", Addison-Wesley Professional, Illustrated Edition, 2003.
2. Garms, Jess, Daniel Somerfield, "Professional Java Security", Wrox Press, Illustrated Edition, 2001.

Reference Books:

1. Nelson Phillips, Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata Mc Graw Hill,
3. Robert M Slade, "Software Forensics", Tata Mc Graw Hill, New Delhi, 1st Edition, 2005.

Web References:

1. http://www.mail.nih.gov/user/faq/tlsssl.htm
2. http://www.openssl.org/
3. http://www.ntsecurity.net/

E-Text Books:

1. https://www.mitre.org/sites/.../pr-13-1028-mitre-10-strategies-cyber-ops-center.pdf
2. https://www.coursera.org/specializations/cyber-security
3. https://www.ccdcoe.org/publications/books/NationalCyberSecurityFrameworkManual.pdf

DISTRIBUTED OPERATING SYSTEM LABORATORY

II Semester: CSE							

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCS102	**Core**	-	-	3	2	30	70	100

Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36	Total Classes: 36

OBJECTIVES:
The course should enable the students to:
I.   Understand the design aspects of operating system.
II. Exposure on usage of various operating systems.
III. Design modern distributed system components.

LIST OF EXPERIMENTS

Week-1 **CPU SCHEDULING ALGORITHMS**

Simulate the following CPU scheduling algorithms
   a) Round Robin b) SJF c) FCFS d) Priority

Week-2 **FILE ALLOCATION STRATEGIES**

Simulate all file allocation strategies
   a)   Sequential b) Indexed c) Linked

Week-3 **PROCESS MANAGEMENT**

Implement process strategies: creation of child, zombie, orphan process

Week-4 **FILE ORGANIZATION STRATEGIES**

Implement file organization strategies
   a) single level b) Two level c) Hierarchical

Week-5 **DEAD LOCK AVOIDANCE**

Simulate Bankers Algorithm for Dead Lock Avoidance

Week-6 **DEAD LOCK PREVENTION**

Simulate Bankers Algorithm for Dead Lock Prevention

Week-7 **PAGE REPLACEMENT ALGORITHMS**

Simulate all page replacement algorithms
   a)   FIFO b) LRU c) LFU

Week-8	SHARED MEMORY AND SEMAPHORE

Implement shared memory and semaphore concepts for inter process communication

Reference Books:

Andrew S. Tanenbaum, "Distributed Operating System", PHI, 1st Edition, 1994.

Web References:

1. www.cs.put.poznan.pl/pawelw/sus/dcs07.doc
2. https://developer.apple.com/library/mac/documentation

SOFTWARE AND HARDWARE REQUIREMENTS FOR 18 STUDENTS:

SOFTWARE: Turbo C/ J2SE

HARDWARE: 18 numbers of Intel Desktop Computers with 2 GB RAM

SOFTWARE DEFINED NETWORKS

Group I : CSE	II Semester: SE							

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BSE004	Core/ Elective	3	-	-	3	30	70	100

Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the students to:

I. Understand the software project planning and standards.

II. Explore on components of formal methods.

III.Able to understand component based software engineering.

UNIT-I	SOFTWARE PROJECT MANAGEMENT	Classes: 09

Software project management: Software project planning and its characteristics, types of metrics; Effort estimation: FP, LOC, FP vs. LOC; Schedule and cost estimation models; Activity networks: PERT, CPM, COCOMO-I, COCOMO-II, risk assessment probability matrix, risk management; Agile methodology: Scrum and XP.

UNIT-II	FORMAL METHODS	Classes: 09

Formal methods: Basic concepts, mathematical preliminaries, applying mathematical notions for formal specification, formal specification languages, using Z to represent an example software component, ten commandments of formal methods, formal methods the road ahead.

UNIT-III	COMPONENT-BASED AND CLIENT / SERVER SOFTWARE ENGINEERING	Classes: 09

Component-based software engineering: CBSE process, domain engineering, component based development, classifying and retrieving components and economics of CBSE.

Client/Server software engineering: Structure of client/server systems, software engineering for client/server systems, analysis modeling issues, design for client/server systems, testing issues.

UNIT-IV	WEB ENGINEERING AND RE ENGINEERING	Classes: 09

Web engineering: Attributes of web-based applications; WebE process: A framework for WebE; Formulating: Analyzing web based systems, design and testing for web based applications, Management issues; Reengineering: Business process reengineering, software reengineering, reverse reengineering, restructuring, forward reengineering and economics of reengineering.

UNIT-V	SOFTWARE QUALITY AND COMPUTER AIDED SOFTWARE ENGINEERING	Classes: 09

Software quality: CASE tools, metrics, standards, certification and assessment; TQM, Bootstrap methodology, the SPICE project, ISO-IEC 15504, six sigma concept for software quality; Computer aided software engineering: Building blocks for CASE, taxonomy of CASE tools, integrated CASE environments, integration architecture, and CASE; Repository analytic modeling: Introduction, queuing theory, Markov process.

Text Books:

1. Roger S. Pressman, "Software Engineering a Practitioners Approach", Mc Graw Hill, 8th Edition, 2014.
2. J. Bowan, "Formal Specification and Documentation testing - A Case Study Approach", International Thomson Computer Press, 3rd Edition, 2003.

Reference Books

1. Robert Oshana, Mark Kraeling, "Software Engineering for Embedded Systems Methods, Practical and Applications", Newness Publisher, 1st Edition, 2013.
2. James S. Peters, Witold Pedrycz, "Software engineering an engineering approach", Wiley India, 1st Edition, 2007.
3. Hans Van Vliet, "Software Engineering Principles and Practice", John Wiley & Sons, 3rd Edition, 2008.

Web References:

1. http://www .teaching.csse.uwa.edu.au/units/CITS3220/lectures/09projManIntro.pdf
2. http://www.groups.engin.umd.umich.edu/CIS/course.des/cis376/ppt/lec22.ppt

E-Text Books:

1. http://www.vumultan.com
2. http://www.citeseerx.ist.psu.edu
3. http://www.abebooks.com/book-search/author/roger-s-pressman-bruce-r-maxim/

WEB INTELLIGENT AND ALGORITHMS

Group I : CSE | Group IV : SE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCS201	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: 45**

OBJECTIVES:

The course should enable the students to:

I.   Illustrate the fundamental knowledge on web intelligent applications.
II. Summarize the searching and indexing techniques in search engines.
III. Outline the suggestions and recommendations for extracting intelligence from web applications.
IV. Understand the constraint based tag recommender system learning from user interactions.
V.   Apply data mining algorithms to recommendation systems.

UNIT-I	INTRODUCTION AND WEB SEARCHING	Classes: 10

Introduction and web searching: Historical perspective, evolution of web 2.0.; Intelligent web applications: Examples, web searching, indexing; Improving search results based on link analysis, introduction to page rank, avoiding dead ends and spider traps, using page rank in a search engine, efficient computation of page rank, topic sensitive page rank, intelligent web crawling, improving search results based on user clicks, ranking documents, precision and recall.

UNIT-II	CREATING SUGGESTIONS AND RECOMMENDATIONS	Classes: 10

Creating suggestions and recommendations: Concepts of distance and similarity, collaborative filtering, recommendations based on similar users, recommendations based on similar items, recommendations based on content; Extracting intelligence from content: Blogs, wikis, message boards.

UNIT-III	LEARNING FROM USER INTERACTIONS	Classes: 10

Learning from user interactions: Extracting intelligence from tags, tag related metadata, tag generation; Leveraging tags: Dynamic navigation, using tag clouds, targeted search, recommendations based on tags constraint based recommender systems, hybrid recommender systems.

UNIT-IV	RECOMMENDER SYSTEM TYPES	Classes: 07

Recommender system types: Constraint based recommender systems, neighborhood based recommendation systems and hybrid recommender systems.

UNIT-V	DATA MINING METHODS IN RECOMMENDATION SYSTEMS	Classes: 08

Data mining methods in recommendation systems: Classifiers, clustering, association rule mining techniques, explanations in recommender systems, evaluating recommender systems, advertising on the web, on line and off line algorithms, the matching problem, adwords problem, Web 3.0 and the semantic web, the next generation web.

Text Books:

1. Haralambos Marmanis, Dmitry Babenko, "Algorithms of the Intelligent Web", Dreamtech Press, 2nd Edition, 2016.
2. Segaran, "Programming Collective Intelligence", O'reilly, 1st Edition, 2007.
3. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information Retrieval", Cambridge University Press, 1st Edition, 2008.

Reference Books:

1. Berners Lee, Godel, Turing, "Thinking on the Web", Wiley Inter Science, 1st Edition, 2009.
2. Gautam Shroff, "Intelligent Web - Search, Smart Algorithms, and Big Data", Oxford University Press, 1st Edition, 2013.
3. Haralambos Marmanis, Dmitry Babenko, "Algorithms of the Intelligent Web", Manning Publications, 1st Edition, 2009.

Web References:

1. https://www.en.wikipedia.org/wiki/Web_intelligence
2. https://www.coursetalk.com/providers/coursera/courses/web-intelligence-and-big-data
3. http://www.searchengineland.com/meet-rankbrain-google-search-results-234386
4. http://www.link.springer.com/chapter/10.1007

E-Text Books:

1. http://www.hackerspace.cs.rutgers.edu/library/Bioloid/plans/AlgorithmsIntelligentWeb.pdf
2. http://www.pdf-filez.com/de/gratis.php?asin=B00F8QDZWG

OPTIMIZATION TECHNIQUES

Group I: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS202	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45		**Total Tutorials: Nil**		**Total Practical Classes: Nil**		**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Introduce fundamental concepts of optimization techniques and understand the theory of optimization methods and algorithms.
II. Make aware of the importance of optimizations in real scenarios.
III. Provide the concepts of various classical and modern methods for constrained and unconstrained problems.
IV. Apply the mathematical and numerical techniques of optimization theory to concrete engineering problems.

UNIT-I	INTRODUCTION	Classes: 09

Introduction to classical methods and linear programming, problems terminology, design variables, constraints, objective function, problem formulation, calculus method, Kuhn tucker conditions, method of multipliers; Linear programming problem: Simplex method, concept of duality.

UNIT-II	SINGLE VARIABLE OPTIMIZATION	Classes: 09

Single variable optimization problems optimality criterion, bracketing methods, region elimination methods, interval halving method, Fibonacci search method, golden section method; Gradient based methods: Newton-Raphson method, bisection method, secant method, application to root finding.

UNIT-III	MULTIVARIABLE OPTIMIZATION ALGORITHMS	Classes: 09

Multivariable optimization algorithms optimality criteria, unidirectional search; Direct search methods: Hooke and Jeeves pattern search method, Powell's conjugate direction method.

Gradient based methods: Cauchy's steepest descent method, Newton's method, Levenberg-Marquardt method.

UNIT-IV	PROGRAMMING TYPES	Classes: 09

Quadratic programming, integer programming, penalty function method, branch and bound method, geometric programming, dynamic programming, genetic algorithm.

UNIT-V	IVENTORY MODELS	Classes: 09

Decision theory, decision tree, game theory; Inventory models: Deterministic models, probabilistic models; Queuing theory, simulation applications.

Text Books:

1. Singiresu S Rao, "Engineering Optimization: Theory and Practice", New Age International, 3 rd Edition, 2010.
2. Handy A Taha, "Operations Research – An Introduction", Prentice Hall of India, New Delhi, 7th Edition, 2003.

Reference Books:

1. J K Sharma, "Operations Research Theory and Applications", Mac Millan India Ltd, 3rd Edition, 2006.
2. N D Vohra, "Quantitative Techniques in Management", Tata McGraw Hill, 3rd Edition, 2007.
3. Wagner H M, "Principles of Operations Research: With Applications to Management Decisions", Prentice-Hall of India, 1st Edition, 1982.
4. Payne T A, "Quantitative Techniques for Management: A Practical Approach", Reston Publishing Co. Inc., Virginia, 1st Edition, 1982.
5. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall of India Pvt. Ltd, New Edition, 2004.

Web References:

1. https://www.en.wikipedia.org/wiki/Mathematical_optimization
2. http://www.nptel.ac.in/courses/Webcourse-contents/IISc

E-Text Books:

1. http://www.saba.kntu.ac.ir/eecd/taghirad/E%20books/TOC/Engineering/Optimization.pdf
2. https://www.books.google.co.in/books/about/Operations_Research_3_Edition_Theory_And.html

ENTERPRISE WIDE INFORMATION SYSTEMS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCS203	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:
The course should enable the students to:
I.   Motivated for organizations to develop or adopt enterprise wide information systems.
II. Learn the alternative perspectives on data to be included in an enterprise wide information system.
III. Understand how integrated systems facilitate electronic commerce, supply chain management, customer relationship management and manufacturing.

UNIT-I	INTRODUCTION TO ERP	Classes: 10

Integrated management information seamless integration, supply chain management, integrated data model, benefits of ERP, business engineering and ERP, definition of business engineering, principle of business engineering ,business engineering with information technology.

UNIT-II	BUSINESS MODELLING FOR ERP	Classes: 10

Building the business model, ERP implementation: An overview, role of consultant, vendors and users, customization, precautions, ERP post implementation options, ERP implementation technology, guidelines for ERP implementation.

UNIT-III	ERP AND THE COMPETITIVE ADVANTAGE ERP	Classes: 08

Domain MPGPRO, IFS/Avalon, industrial and financial systems.

Baan IV SAP market dynamics and dynamic strategy.

UNIT-IV	COMMERCIAL ERP PACKAGE	Classes: 09

Description, multi-client server solution, open technology, user interface application integration.

UNIT-V	ARCHITECTURE	Classes: 08

Basic architectural concepts, the system control interfaces, services, presentation interface, database interface, cases.

Text Book:

Vinod Kumar Garg, N. K. Venkita Krishnan, "Enterprise Resource Planning – Concepts and Practice", PHI, 1st Edition, 1998.

Reference Books:

1. Jose Antonio Fernandz, "The SAP R/3 Handbook", TMH, 1ˢᵗ Edition, 1998.
2. Daniel E O'Leary, "Enterprise Resource System: Systems, Lifecycle, Electronic Commerce, Risk", 1ˢᵗ Edition, 2000.
3. Mary Sumner, "Enterprise Resource Planning", Pearson New International, 1st Edition, 2000.
4. Simha R. Magal, Jeffrey, "Integrated Business Processes with ERP Systems", Wiley, 1ˢᵗ Edition, 2011.

Web References:

1. http://www.link.springer.com/chapter/10.1007%2F978-3-322-82845-3_8#page-2
2. http://www.igi-global.com/book/modelling-analysis-enterprise-information-systems/767

E-Text Books:

1. http://www.mit.edu/ pdf.
2. http://www.promeng.eu/downloads/training.../ebooks/business-information-systems.pdf

ADVANCED WEB TECHNOLOGIES

Group II: CSE	**Group III: SE**							

Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS204	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: 45**

OBJECTIVES:

The course should enable the students to:

I. Describe client side technologies.
II. Implement database connections.
III. Develop JSP applications.
IV. Understand service oriented concepts and web services.

UNIT-I	**CLIENT SIDE TECHNOLOGIES**	**Classes: 09**

Overview of HTML: Common tags for text formatting, lists, tables, images, forms, frames etc., XHTML cascading style sheets, linking to HTML pages, classes in CSS, general CSS statements for text, table, list and page formatting; Introduction to JavaScripts: Variables, arrays, methods and string manipulation, Browser/Document Object Model, accessing elements by ID, objects in JavaScript, dynamic HTML with JavaScript and with CSS, form validation with JavaScript, handling timer events, JQuery.

UNIT-II	**INTRODUCTION TO JAVA SERVLETS**	**Classes: 09**

Introduction to servlets: Lifecycle of a servlet, reading request and initialization parameters, writing output to response, mime types in response; Session tracking: Using cookies and sessions, steps involved in deploying an application, database access with JDBC and connection pooling; Introduction to XML: XML parsing with DOM and SAX parsers in java, AJAX programming with JSP/Servlets, creating XML http object for various browsers, sending request, processing response data and displaying it, introduction to hibernate.

UNIT-III	**INTRODUCTION TO JSP**	**Classes: 09**

JSP application development: Types of JSP constructs (directives, declarations, expressions, code snippets), generating dynamic content, exception handling, implicit JSP objects, conditional processing, sharing data between JSP pages, sharing session and application data.

Using user defined classes with jsp: UseBean tag, accessing a database from a JSP.

UNIT-IV	**INTRODUCTION TO STRUTS FRAMEWORK**	**Classes: 09**

Introduction to MVC architecture, anatomy of a simple struts application, struts configuration file, presentation layer with jsp, jsp bean, html and logic tag libraries, struts controller class, using form data in actions, page forwarding, validation frame work, internationalization.

UNIT-V	SERVICE ORIENTED ARCHITECTURE AND WEB SERVICES	Classes: 09

Overview of service oriented architecture: SOA concepts, key service characteristics, technical benefits of a SOA; Introduction to web services: The definition of web services, basic operational model of web services, basic steps of implementing web services; Core fundamentals of SOAP: SOAP message structure, SOAP encoding, SOAP message exchange models; Describing web services: Web services life cycle, anatomy of WSDL; Introduction to axis installing axis web service framework, deploying a java web service on axis; Web services interoperability creating java and .Net client applications for an axis web service; Note: the reference platform for the course will be open source products apache tomcat application server, MySQL database, Hibernate and Axis.

Text Books:

1. Chris Bates, "Web Programming, Building Internet Applications", Wiley Dreamtech, 3rd Edition, 2014.
2. Herbert Schildt, "The Complete Reference Java", TMH, 7th Edition, 2006.
3. Hans Bergsten, "Java Server Pages", O'Reilly, 3rd Edition, 2003.
4. Richard Hightower, "Professional Jakarta Struts - James Goodwill", Wrox Publishers, 1st Edition, 2003
5. R. Nagappan, R. Skoczylas, R. P. Sriganesh, "Developing Java Web Services", Wiley India, 3rd Edition, 2008.
6. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services" , Pearson, 1st Edition, 2009.

Reference Books:

1. R. W. Sebesta "Programming the World Wide Web", Pearson, 4th Edition, 2008.
2. Dietel, Nieto "Internet and World Wide Web – How to Program", PHI/Pearson, 5th Edition, 2014.

Web References:

1. https://www.goodreads.com/book/show/3729666-web-programming
2. https://www.ftp://ftp.bupt.edu.cn
3. https://www.dl.acm.org/citation

E-Text Books:

1. https://books.google.co.in/books/about/WEB_PROGRAMMING_BUILDING_INTERNET_APPLIC. html
2. http://iiti.ac.in/people/~tanimad/JavaTheCompleteReference.pdf
3. http://se.csie.dyu.edu.tw/lairrol/files/JAVAEC/O'Reilly.pdf

WIRELESS COMMUNCATIONS AND NETWORKS

Group II: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCS205	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: 45**

OBJECTIVES:
The course should enable the students to:

I. Understand the examples of wireless communication systems, paging systems, cordless telephone systems.
II. Study the different generations of mobile networks, WAN and PAN.
III. Illustrate the concepts of basic cellular system, frequency reuse, channel assignment strategies, handoff strategies.
IV. Understand the mobile communication protocols.
V. Evaluate the WAN industry, wireless home networking IEEE 802.11 the physical layer.

UNIT-I	**INTRODUCTION TO WIRELESS NETWORKING**	**Classes: 09**

Introduction to wireless networking: Introduction to wireless networks, difference between wireless and fixed telephone networks, development of wireless networks, traffic routing in wireless networks, examples of wireless communication systems, paging systems, cordless telephone systems, compression of various wireless systems.

UNIT-II	**MOBILE WIRELESS COMMUNICATION SYSTEMS**	**Classes: 09**

Mobile wireless communication systems: Evaluation of mobile radio communications second generation cellular networks, third generation wireless networks, wireless in local loop, wireless local area networks; Multiple access techniques for wireless communication: Introduction to multiple accesses, FDMA, TDMA, spread spectrum, multiple accesses, SDMA, packet radio, packet radio protocols, CSMA protocols, reservation protocols.

UNIT-III	**WIRELESS DATA SERVICES**	**Classes: 09**

Wireless data services: CDPD, ARDIS, RMD, common channel signaling, ISDN, BISDN and ATM, SS7, SS7 user part, signaling traffic in SS7.

Mobile IP and wireless access protocol: Mobile IP operation of mobile IP, collocated address, registration, tunneling, WAP architecture, overview, WML scripts, WAP service, WAP session protocol, wireless transaction, wireless datagram protocol.

UNIT-IV	**WIRELESS LAN AND WIRELESS LAND**	**Classes: 09**

Wireless LAN technology: Infrared LANS, spread spectrum LANS, narrow bank microwave LANS, blue tooth overview, radio specification, base band specification, links manager specification, and logical link control and adaptation protocol, introduction to WLL technology; Wireless land: Historical overviews of the land industry, evolution of the wan industry, wireless home networking IEEE 802.11 the physical layer, MAC layer wireless ATM, hyperlink, hyperlan-2.

UNIT-V	INFORMATION EXTRACTION AND MACHINE TRANSLATION	Classes: 09

Wireless WAN: Mechanism to support at mobile environment, communication in the infrastructure , IIS95 CDMA forward channel, IS95 CDMA risers channel, packet and frame formats in IS95, IMT-20000, forward channel in W-CDMA and CDMA 2000, reverse channels in W-CDMA and CDMA - 2000 GPRS and higher data rates, short messaging service in GPRS mobile application protocols.

Text Books:

1. Theodore, S. Rappaport, "Wireless Communications, Principles, Practice", PHI, 2nd Edition, 2002.
2. William Stallings, "Wireless Communication and Networking", PHI, 2nd Edition, 2003.

Reference Books:

1. Kamilo Feher, "Wireless Digital Communications", PHI, 1st Edition, 1999.
2. Kaveh Pah Laven, P. Krishna Murthy, "Principles of Wireless Networks", Prentice Hall PTR, 1st Edition, 2002
3. Andreaws F. Molisch, "Wireless Communications", Wiley India, 2nd Edition, 2006.

Web References:

1. http://www.yiritech.com/en/products/71.html? .
2. https://www.pearsonhighered.com/product/Stallings-Wireless-Communications-Networks-2nd Edition.
3. http://nptel.ac.in/video.php?subjectId=117102062

E-Text Books:

1. http://www.cwins.wpi.edu/publications/pown/.
2. http://keshi.ubiwna.org/2015IotComm/Wireless_Communications_&_Networking_Stallings_2nd.pdf

ANDROID APPLICATION DEVELOPMENT

Group II : CSE | **Group III : SE**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCS206	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes:45

OBJECTIVES:
The course should enable the students to :
I. Understand the essentials of mobile application development.
II. Explore on the core modules designing, developing, testing, signing, packaging and distributing high quality mobile applications.
III. Illustrate on mobile application development using Android as the development platform.

UNIT-I	INTRODUCTION TO MOBILE	Classes:09

History of mobile, mobile ecosystem, need of mobile, types of mobile applications, mobile information architecture, mobile design, mobile 2.0, mobile web development, small computing device requirements.

UNIT-II	INTRODUCTION TO ANDROID	Classes:09

History of mobile software development, open handset alliance, android platform, android sdk, eclipse installation, android installation, building a sample android application

UNIT-III	ANDROID APPLICATION DESIGN ESSENTIALS	Classes:09

Anatomy of an android applications, android terminologies, application context, activities, services, intents, receiving and broadcasting intents.
Android manifest file and its common settings, using intent filter, permissions, managing application resources in a hierarchy, working with different types of resources.

UNIT-IV	ANDROID USER INTERFACE DESIGN ESSENTIALS	Classes:09

User interface screen elements, designing user interfaces with layouts, drawing and working with animation

UNIT-V	USING COMMON ANDROID APIS	Classes:09

Android data and storage APIs, managing data using SQLite, sharing data between applications with content providers, using Android networking APIs, using Android web APIs, Using Android telephony APIs, deploying Android application to the world.

Text Books:
1. James Keogh, "J2ME: The Complete Reference", Tata McGrawHill. 2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd Edition, 2011.

Reference Books:
1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd 2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd 3. Sayed Y Hashimi and Satya Komatineni, "Pro Android", Wiley India Pvt Ltd. 4. Barry Burd, "Android Application Development All in one for Dummies",1st Edition.

Web References:
1. https://developer.android.com/training/basics/firstapp/index.html 2. www.tutorialspoint.com/android/ 3. https://www.udacity.com/course/android-development-for-beginners--ud837

E-Text Books:
1. http://ebuksmania.blogspot.in/2012/06/j2me-complete- reference.html 2. http://jfod.cnam.fr/seja/supports/biblio/Android%20Wireless%20Application%20Development%202nd.pdf

<h1 style="text-align:center">INTERNET OF THINGS</h1>

Group II : CSE | Group III: SE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCS207	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 45

OBJECTIVES:
The course should enable the students to:
I. Understand the architecture of Internet of Things and connected world.
II. Explore on use of various hardware, communication and sensing technologies to build IoT applications.
III. Illustrate the real time IoT applications to make smart world.
IV. Understand challenges and future trends in IoT.

UNIT-I	INTRODUCTION TO INTERNET OF THINGS	Classes: 10

Introduction: Definition of IoT, fundamental characteristics of IoT, design considerations for IoT applications; Basic layered architecture for IoT: Device layer, network layer, service and application support layer, application layer.

UNIT-II	KEY ENABLING TECHNOLOGIES,PROTOCOLS	Classes: 10

Platforms: Hardware, soc, sensors, cloud computing and IoT, Bluetooth, BT-LE, beacon, Raspberry Pi, Arduino; Protocols: Identification; Tracking technologies: RFID, NFC, Zigbee; GPS communication technologies: Wireless networks, WSN, 3G, LTE, and IPv6.

UNIT-III	INTERNET OF THINGS IN APPLICATIONS	Classes: 10

Internet of things in applications I: IoT for smart cities, IoT for traffic management and transportation, IoT in the home.

Internet of things in applications II: IoT in retail, IoT in healthcare, IoT in sports.

UNIT-IV	SERVICES AND ATTRIBUTES FOR IOT	Classes: 07

Services and attributes for IoT: Big-data analytics and visualization, dependability, security, localization, maintainability.

UNIT-V	CHALLENGES AND FUTURE TRENDS	Classes: 08

Challenges and future trends: research challenges: technical challenges, standardization, information security and privacy protection, research trends.

Text Books:

1. Ovidiu Vermesan, Peter Friess, "Internet of Things – From Research and Innovation to Market Deployment", River Publishers, 1st Edition, 2014.
2. Ovidiu Vermesan, Peter Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, 1st Edition, 2013.

Reference Books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Wiley, 2nd Edition, 2012.
2. Ovidiu Vermesan, Peter Friess, "Building the Hyper connected Society", River Publishers, 2nd Edition, 2015.
3. David Boswarthick, Omar Elloumi, Olivier Hersent, "M 2 M Communications: A Systems Approach", John Wiley & Sons, 2nd Edition, 2012.
4. Adrian Mc Ewen, Hakim Cassimally, "Designing the Internet of Things", John Wiley & Sons, 1st Edition, 2013.

Web References:

1. http://www.cncpvc.com/the-internet-of-things-key-applications-and-protocols.pdf
2. http://www.libelium.com/resources/top_50_iot_sensor_applications_ranking/

E-Text Books:

1. http://www.internet-of-things-research.eu/pdf
2. http://www.internet-of-things research.eu/pdf

SOFT COMPUTING

Group III: CSE							

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCS208	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 45

OBJECTIVES:
The course should enable the students to:
I. Familiarize with soft computing concepts.
II. Understand supervised learning and unsupervised learning networks.
III. Introduce the ideas of neural networks, fuzzy logic.

UNIT-I	INTRODUCTION TO NEURAL NETWORKS	Classes: 09

Introduction: Fundamental concept, evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron, linear separability, Hebb network; Supervised learning network: Perception networks, adaptive linear neuron, multiple adaptive linear neurons, back propagation network, radial basis function network.

UNIT-II	ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS	Classes: 09

Associative memory networks: Training algorithms for pattern association, auto associative memory network, hetero associative memory network, bidirectional associative memory, Hopfield networks, iterative auto associative memory network, temporal associative memory network; Unsupervised learning networks: Kohonen self organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.

UNIT-III	FUZZY LOGIC	Classes: 09

Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets.

Membership functions: Fuzzification, methods of membership value assignments, defuzzification, Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.

UNIT-IV	FUZZY ARITHMETIC	Classes: 09

Fuzzy arithmetic and fuzzy measures: Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic, fuzzy propositions, formation of rules, decomposition and aggregation of rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making, fuzzy logic control systems, fuzzy expert systems.

UNIT-V	GENETIC ALGORITHMS	Classes: 09

Genetic algorithm and search space, general genetic algorithm, operators, generational cycle, stopping condition, constraints, classification, genetic programming, multilevel optimization; Applications: A fusion approach of multispectral images with SAR image for flood area analysis, optimization of travelling salesman problem using genetic algorithm approach, and genetic algorithm based internet search technique, soft computing based hybrid fuzzy controllers.

Text Books:

1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro, "Fuzzy and Soft Computing", PHI, Pearson Education, 1st Edition, 2004.
2. S. N. Sivanandan, S. N. Deepa, "Principles of Soft Computing", Wiley India, 2nd Edition, 2007.

Reference Books:

1. S. Rajasekaran, G. A. V. Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 1st Edition, 2003.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Mc Graw Hill, 3rd Edition, 1997.
3. Stamatios V. Kartalopoulos "Understanding Neural Networks and Fuzzy Logic Basic Concepts and Applications", IEEE Press, PHI, New Delhi, 2004.

Web References:

1. http://www.sctie.iitkgp.ernet.in/
2. http://www.rkala.in/softcomputingvideos.php
3. http://www.sharbani.org/home2/soft-computing-1
4. http://www.myreaders.info/html/soft_computing.html

E-Text Books:

1. https://www.books.google.co.in/books?id=bVbj9nhvHd4C
2. https://www.books.google.co.in/books?id=GrZHPgAACAAJ&dq=1.+J.S.R.Jang,+C.T.Sun+and+E. Mizutani,+Neuro,+Fuzzy+and+Soft+Computing,+PHI,+2004,Pearson+Education.

NATURAL LANGUAGE PROCESSING

Group III : CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS209	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:
I.   Understand the linguistic concepts and natural language complexity and variability.
II. Acquire knowledge on machine learning techniques as applied to language.
III. Implement n-grams models.

UNIT-I	INTRODUCTION	Classes: 09

Introduction and overview, hands-on demonstrations, ambiguity and uncertainty in language; The turing test; Regular expressions Chomsky hierarchy; Regular languages and their limitations; Finite-state automata; Practical regular expressions for finding and counting language phenomena; A little morphology; Exploring a large corpus with regex tools; Programming in Python: Introduction, variables, numbers, strings, arrays, dictionaries, conditionals, iteration; NLTK (Natural Language Toolkit): String edit distance and alignment key algorithmic tool; Dynamic programming; A simple example, use in optimal alignment of sequences; String edit operations, edit distance, and examples of use in spelling correction, and machine translation.

UNIT-II	CONTEXT FREE GRAMMARS	Classes: 09

Context free grammars constituency, CFG definition, use and limitations; Chomsky normal form; Top-down parsing, bottom-up parsing, and the problems with each; The desirability of combining evidence from both directions non-probabilistic parsing efficient CFG parsing with CYK, dynamic programming algorithms; Early parser; Designing a grammar and parsing with it on some test data; Probability introduction to probability theory joint and conditional probability, marginal's, independence, Bayes rule, combining evidence, examples of applications in natural language; Information theory the "Shannon game"motivated by language! Entropy, cross- entropy, information gain, its application to some language phenomena.

UNIT-III	LANGUAGE MODELING AND NAIVE BAYES	Classes: 09

Language modeling and Naive Bayes: Probabilistic language modeling and its applications; Markov models; N-grams; Estimating the probability of a word, and smoothing; Generative models of language.

Part of speech tagging and hidden markov models: Viterbi algorithm for finding most likely HMM path dynamic programming with hidden markov models, and its use for part-of-speech tagging, chinese word segmentation, prosody, information extraction.

UNIT-IV	PROBABILISTIC CONTEXT FREE GRAMMARS	Classes: 09

Probabilistic context free grammars: Weighted context free grammars; Weighted CYK; Pruning and beam search; Parsing with PCFGs: A tree bank and what it takes to create one; The probabilistic version of CYK; Also: How do humans parse? Experiments with eye-tracking; Modern parsers; Maximum entropy classifiers: The maximum entropy principle and its relation to maximum likelihood; Maximum entropy classifiers and their application to document classification, sentence segmentation, and other language tasks.

UNIT-V	MAXIMUM ENTROPY MARKOV MODELS	Classes: 09

Maximum entropy markov models and conditional random fields: Part of speech tagging, noun-phrase segmentation and information extraction models that combine maximum entropy and finite-state machines; State of the art models for NLP; Lexical semantics: Mathematics of multinomial and Dirichlet distributions, Dirichlet as a smoothing for multinomial's; Information extraction and reference resolution: Various methods, including HMMs; Models of anaphora resolution; Machine learning methods for co reference.

Text Books:

1. Jurafsky, Martin, "Speech and Language Processing", Prentice Hall, 2nd Edition, 2008.
2. Manning, Schutze, "Statistical Natural Language Processing", MIT Press, 1999.
3. James Allen, "Natural Language Understanding", Cummings Publishing Company, 2nd Edition, 1995.

Reference Books:

1. Cover T. M., J. A. Thomas, "Elements of Information Theory", Wiley, 2nd Edition, 2005.
2. Charnia E, "Statistical Language Learning", MIT Press, 2nd Edition, 2008.
3. Jelinek F, "Statistical Methods for Speech Recognition", MIT Press, 1999.
4. Lutz, Ascher, "Learning Python", O'Reilly, 3rd Edition, 2008.

Web References:

http://www.ps.uni-saarland.de/~niehren/oz-natural-language-script.html/vorlesung/node49.html

E-Text Books:

https://books.google.co.in/books?id=YiFDxbEX3SUCIT

CLUSTER AND GRID COMPUTING

Group III: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCS210	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: 45**

OBJECTIVES:

The course should enable the students to:

I. Understand the cluster computing architecture and its administration.
II. Analyze the mechanism of process scheduling, load sharing and load balancing.
III. Illustrate grid computing techniques and standards.
IV. Learn grid monitoring architecture and different monitoring systems.
V. Discuss grid security and list of globally available middlewares.

UNIT-I	**CLUSTER COMPUTING**	**Classes: 09**

Cluster computing at a glance, cluster setup and its administration, constructing scalable services, dependable cluster computing, deploying a high throughput computing cluster, performance models and simulation, meta computing.

UNIT-II	**PROCESS SCHEDULING, LOAD SHARING, AND BALANCING**	**Classes: 09**

Job and resource management systems, scheduling parallel jobs on clusters, load sharing and fault tolerance manager, parallel program scheduling techniques, customized dynamic load balancing, mapping and scheduling on heterogeneous systems.

UNIT-III	**GRID COMPUTING**	**Classes: 09**

Introduction: parallel and distributed computing, cluster computing, grid computing, anatomy and physiology of grid, web and grid services, grid standards; OGSA.

WSRF: Trends, challenges and applications.

UNIT-IV	**GRID MONITORING**	**Classes: 08**

Grid monitoring architecture (GMA): An overview of grid monitoring systems, R-GMA, GridICE, MDS, service level agreements (SLAs), other monitoring systems, Ganglia, Gridmon, Hawkeye and network weather service.

UNIT-V	**GRID SECURITY AND MIDDLEWARE**	**Classes: 10**

Grid Security: A brief security primer PKI-X509 certificates, grid security, grid scheduling and resource management, list of globally available middlewares, features of next generation grid; Case studies: Recent version of globus toolkit and gLite.

Text Books:
1. Rajkumar Buyya, "High performance cluster computing: Architectures and Systems", Prentic Hall PTR, NJ, USA, 2nd Edition, 1999. 2. Maozhen Li, Mark Baker, "The Grid Core Technologies", John Wiley and Sons, Illustrated 8th Edition, 2005.

Reference Books:
1. C S R Prabhu, "Grid and Cluster Computing", PHI, 1st Edition, 2008. 2. Ian Foster, Carl Kesselman, "The Grid 2 Blueprint for a New Computing Infrastructure", Morgan Kaufman, 2nd Edition, 2004. 3. Joshy Joseph, Craig Fellenstein, "Grid Computing", Pearson Education, 1st Edition, 2004. 4. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, "Grid Computing: Making the Global Infrastructure a Reality", John Wiley and Sons, 1st Edition, 2003.

Web References:
1. https://www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf 2. http://www.d.umn.edu/~joshi031/files/grid-computing.pdf 3. https://www.cs.fsu.edu/~engelen/courses/HPC-adv-2008/Grid.pdf 4. http://www.cs.kent.edu/~farrell/grid04/reference/ 5. http://www.cloudbus.org/papers/ic_cluster.pdf

E-Text Books:
1. http://www.freebookcentre.net/ComputerScience-Books-Download/Fundamentalsof-Grid-Computing 2. https://www.crcpress.com/Grid-Computing-Techniques-and-Applications/Wilkinson/p/book/97599 3. http://www.springer.com/kr/book/9783540335399

COMPUTER VISION

Group III : CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	
BCS211	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: 45**

OBJECTIVES:
The course should enable the students to:
I. Understand and apply a series of probabilistic models of images.
II. Understand the objects in computer vision systems.

UNIT-I	**INTRODUCTION**	**Classes: 09**

Two-dimensional visual geometry: 2D transformation family, tomography, estimating 2D transformations, image panoramas; 3D image geometry: The projective camera, camera calibration, recovering pose to a plane.

UNIT-II	**MULTIPLE CAMERAS**	**Classes: 09**

Multiple Cameras: The fundamental and essential matrices, sparse stereo methods, rectification, building 3D models, shape from silhouette; Vision at a single pixel: Background subtraction and color segmentation problems, parametric, non- parametric and semi-parametric techniques, fitting models with hidden variables.

UNIT-III	**CONNECTING PIXELS AND TEXTURE**	**Classes: 09**

Connecting pixels: Dynamic programming for stereo vision, Markov random fields, MCMC methods; Graph cuts.

Texture: Texture synthesis, super-resolution and denoising, image in painting the epitome of an image.

UNIT-IV	**OBJECT RECOGNITION**	**Classes: 09**

Dense object recognition: Modelling covariances of pixel regions, factor analysis and principle component analysis; Sparse object recognition: Bag of words, latent Dirichlet allocation, and probabilistic latent semantic analysis.

UNIT-V	**FACE RECOGNITION**	**Classes: 09**

Face recognition: Probabilistic approaches to identity recognition, face recognition in disparate viewing conditions; Shape analysis: Point distribution models, active shape models; Active appearance models Tracking: Kalman filter, condensation algorithm.

Text Books:

Simon J.D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 1st Edition, 2012.

Reference Books:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 1st Edition, 2010.
2. David Barber, "Bayesian Reasoning and Machine Learning", Cambridge University Press, 2011.
3. Richard Hartley, Andrew Zisserman, "Multiple View Geometry in Computer Vision", Cambridge University Press, 2nd Edition, 2004.
4. Mark S. Nixon, Alberto S. Aguado, "Feature Extraction and Image Processing", Newens, Illustrated Reprint, 2002.
5. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag New York, 1st Edition, 2006.

Web References:

1. http://mesh.brown.edu/engn1610/szeliski/03-imageprocessing.pdf
2. http://meghnad.iucaa.ernet.in/~tarun/pprnt/pedag_rev/infothery_learningalgo_book.pdf
3. http://www.inference.phy.cam.ac.uk/itprnn/book.pdf

E-Text Books:

1. http://szeliski.org/Book/drafts/SzeliskiBook_20100903_draft.pdf
2. http://www.sci.utah.edu/~gerig/CS6320-S2013/Materials/pages-1-28-Ch1-sm.pdf

BIG DATA ANALYTICS

Group IV: CSE / SE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS212	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand about big data.

II. Learn the analytics on big data.

III. Explore on map reduce fundamentals.

UNIT-I	DATA MANAGEMENT	Classes: 09

Data management: Introduction to big data; history of data management: Design data architecture and manage the data for analysis, understand various sources of data like sensors/signal/GPS, structuring big data, elements of big data, big data analytics, distributed and parallel computing for big data, example export all the data onto cloud ex. AWS/Rackspace etc; Big data analytics: Introduction, classification of analytics, greatest challenges that prevent business from capitalizing big data, top challenges facing big data, big data analytics importance, data science; Data scientist, terminologies used in big data environments, basically available soft state eventual consistency (BASE), open source analytics tools.

UNIT-II	BIG DATA ANALYTICAL APPROACHES AND TOOLS	Classes: 09

Understanding analytics and big data: Comparing reporting and analysis, types of analytics, points to consider during analysis, developing an analytic team, understanding text analytics; Analytical approach and tools to analyze data: Analytical approaches, history of analytical tools, introducing popular analytical tools, comparing various analytical tools.

UNIT-III	MAP REDUCE AND HBASE	Classes: 09

Understanding map reduce fundamentals and HBase: The map reduce framework, techniques to optimize map reduce jobs, uses of map reduce, role of HBase in big data processing; Storing data in Hadoop: Introduction of HDFS, architecture, HDFC files, file system types, commands, org.apache.hadoop.io package, HDF, HDFS high availability.

Introduction to HBase: Architecture, storing big data with HBase, interacting with the hadoop ecosystem, HBase in operations programming with Hbase, installation, combining HBase and HDFS.

UNIT-IV	HADOOP	Classes: 09

Big data technology landscape and hadoop: NoSQL, Hadoop, RDBMS versus hadoop, distributed computing challenges, history of hadoop, hadoop overview; use case of hadoop, hadoop distributors, HDFC, HDFC daemons, read, write, replica processing of data with hadoop, managing resources and applications with hadoop YARN.

UNIT-V	SOCIAL MEDIA ANALYTICS AND TEXT MINING	Classes: 09

Social media analytics and text mining: Introducing social media, key elements of social media, text mining, understanding text mining process, sentiment analysis, performing social media analytics and opinion mining on tweets; Mobile analytics: Introducing mobile analytics, define mobile analytics, mobile analytics and web analytics, types of results from mobile analytics, types of applications for mobile analytics, introducing mobile analytics tools.

Text Books:

1. Seema Acharya, Subhasinin Chellappan, "Big Data and Analytics", Wiley Publications, 2nd Edition, 2014.
2. DT Editorial Services, "Big Data", Dream Tech Press, 2nd Edition, 2015.
3. Albright, Winston, "Business Analytics", Cengage Learning, 6thEdition, 2015.

Reference Books:

1. Rajiv Sabherwal, Irma Becerra- Fernandez, "Business Intelligence –Practice, Technologies and Management", John Wiley, 1st Edition, 2011.
2. Lariss T. Moss,ShakuAtre, "Business Intelligence Roadmap", Addison-Wesley It Service, 2nd Edition, 2011.
3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", Shroff Publishers and Distributers , 2nd Edition, 2012.

Web References:

1. https://www.sas.com/en_us/insights/analytics/big-data-analytics.html
2. https://www.searchbusinessanalytics.techtarget.com/definition/big-data-analytics
3. https://www.webopedia.com

E-Text Books:

1. https://www.books.google.co.in/books?id=rkWPojgfeM8C&printsec=frontcover&dq=HIGH+PERF ORMANCE+COMPUTIN
2. http://www.datameer.com/pdf/big-data-analytics-ebook.pdf?mkt_tok

BUSINESS INTELLIGENCE

GROUP IV : CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS213	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Illustrate the most salient metrics and gets familiarized with BI methodologies.
II. Identify data sources and learns data warehousing concepts.
III. Understand data mining concepts and implementation of business intelligence.

UNIT-I	INTRODUCTION	Classes: 09

Changing business environments and computerized decision support, a framework for business intelligence, intelligence creation and use in governance, transactional processing versus analytical processing, successful business intelligence implementation, tools and techniques.

UNIT-II	DATA WAREHOUSING AND BUSINESS REPORTING	Classes: 09

Definition and concepts, DW process overview, architectures, data integration and extraction, transformation and load(ETL) processes, implementation issues, real time data warehousing, overview, strategies, performance measures, methodologies, applications.

UNIT-III	DATA MINING FOR BI	Classes: 09

Definitions, methods, process; Text mining: NLP, text mining applications, process, tools.

Web mining: Web mining process, methods; BI implementation: Integration and emerging trends, issues of legality, ethics.

UNIT-IV	BI FOUNDATIONS	Classes: 09

Understanding BI, describing BI, defining BI cycle, enabling BI, bridging the analysis gap-multidimensional analysis, operation systems, BI systems.

UNIT-V	BI TECHNOLOGIES	Classes: 09

The high level view, reporting and analysis, the data warehouse and data warehousing framework, identifying BI opportunities; Implementing a BI solution: Implementation strategy, fundamental decisions, case studies, Audi ag, the Frank Russell company.

Text Books:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, David King, Janine E. Aronson, "Business Intelligence", Prentice Hall, 2nd Edition, 2010.
2. David Loshin, "Business Intelligence: The Savy Manager's Guide Getting Onboard with Emerging IT", Morgan Kaufmann Publishers, 2nd Edition, 2009.

Reference Books:

1. Rajiv Sabherwal, Irma Becerra- Fernandez, "Business Intelligence-Practices, Technologies and Management", John Wiley& Sons, illustrated 4th Edition, 2011.
2. Larissa T. Moss, ShakuAtre, "Business Intelligence Roadmap", Addison –Wesley IT Series, 2nd Edition, 2003
3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", Shroff Publishers and Distributers, 3rd Edition, 2012.

Web References:

1. https://en.wikipedia.org/wiki/Business_intelligence
2. https://www.oracle.com/solutions/business-analytics/business-intelligence
3. https://www.isaca.org/chapters1/phoenix/events/.../business_intelligence_overview.ppt

E-Text Books:

1. https://www.safaribooksonline.com/library/.../business-intelligence.
2. https://www.redbooks.ibm.com/redbooks/pdfs/sg245415.pdf
3. https://www.ebooksworld.in/pages/1332

KNOWLEDGE BASED SYSTEMS

Group IV: CSE	Group II: SE							
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCS214	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil		Total Practical Classes: Nil			Total Classes: 45		

OBJECTIVES:
The course should enable the students to:
I.   Learn the concepts of knowledge base and inference engine.
II. Understand expert systems architecture and programming.
III. Explore machine learning rule generation and refinement approaches.

UNIT-I	INTRODUCTION	Classes: 09

Introduction to knowledge engineering: The human expert and an artificial expert , knowledge base and inference engine, knowledge acquisition and knowledge representation.

UNIT-II	PROBLEM SOLVING	Classes: 09

Problem solving process: Rule based systems, heuristic classifications, constructive problem solving.

UNIT-III	EXPERT SYSTEMS	Classes: 09

Tools for building expert systems, case based reasoning, semantic of expert systems, modeling of uncertain reasoning.

Applications: Semiotic theory, designing for explanation.

UNIT-IV	EXPERT SYSTEM ARCHITECTURE AND PROGRAMMING	Classes: 09

Expert system architectures, high level programming languages, logic programming for expert systems.

UNIT-V	MACHINE LEARNING	Classes: 09

Machine learning, rule generation and refinement, learning evaluation, testing and tuning.

Text Books:

1. Peter Jackson, "Introduction to Expert Systems", Pearson Education, 3rd Edition 2007.
2. Robert I. Levine, Diane E. Drang, Barry Edelson, " AI and Expert Systems: A Comprehensive Guide, C Language", McGraw-Hill, 2nd Edition, 1990.

Reference Books:

1 . Jean, Louis Ermine, "Expert Systems: Theory and Practice", Prentice-Hall of India, 4th Edition, 2001.
2 . Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition, 2007.
3 . Padhy N.P., "Artificial Intelligence and Intelligent Systems", Oxford University Press, 4th Impression, 1st Edition, 2007.

Web References:

1. https://www.en.wikipedia.org/wiki/Expert_system
2. https://www.repository.cmu.edu/cgi/viewcontent.cgi?article=1004&context=cee

E-Text Books:

1. http://www.pearsoned.co.uk/bookshop/detail.asp?item=100000000005529

CLOUD INFRASTRUCTURE AND SERVICES

Group IV: CSE / SE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCS215	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 45

OBJECTIVES:
The course should enable the students to:
I.   Understand the fundamentals and essentials of cloud computing.
II. Able to start using and adopting cloud computing services and tools in their real life scenarios.
III. Explore important cloud computing driven commercial systems such as Google apps, Microsoft Azure and Amazon web services and other businesses cloud applications.
IV. Understand the fundamentals and essentials of grid computing and able to start using and adopting Aneka cloud platform as a service.

UNIT-I	DISTRIBUTED SYSTEM MODELS AND ENABLING TECHNOLOGIES	Classes: 09

Scalable computing service over the internet: The age of internet computing, computing trends and new paradigms, internet of things and cyber-physical systems, system models for distributed and cloud computing, clusters of cooperative computers, grid computing infrastructures, peer-to-peer network families, cloud computing over the internet, software environments for distributed systems and clouds, service-oriented architecture, distributed operating systems and software tools, parallel/distributed programming models, performance; Security and energy-efficiency: Performance metrics and scalability analysis, fault-tolerance and system availability, network threats and data integrity, energy-efficiency in distributed computing.

UNIT-II	DESIGN OF CLOUD COMPUTING PLATFORMS	Classes: 09

Cloud computing and service models; Architecture design of compute and storage clouds: A generic cloud architecture design, layered cloud architectural development, virtualization support and disaster recovery, architectural design challenges; Public cloud platforms: GAE, AWS and Windows Azure, public clouds and service offerings, Google Application Engine, Amazon Web Service, Microsoft Windows Azure; Inter- cloud resource management, cloud security and trust management.

UNIT-III	METHODS OF DATA COLLECTION	Classes: 09

Cloud programming and software environments: Features of cloud and grid platforms, cloud capabilities and platform features, traditional features common to grids and clouds, data features and databases, programming and runtime features.

Parallel and distributed programming paradigms: Parallel computing and programming paradigms, Map reduce, twister and iterative map reduce, HADOOP library from apache, mapping applications to parallel and distributed systems, programming support of Google App engine; Programming on Amazon Web Services and Microsoft Azure: Programming on Amazon EC2, Amazon simple storage service S3, Amazon elastic block store EBS and simple DB, Microsoft azure programming support; Emerging cloud software environments.

UNIT– IV	GRID COMPUTING SYSTEMS AND RESOURCE MANAGEMENT	Classes: 09

Grid computing systems and resource management: Grid architecture and service modeling, grid history and service families, CPU scavenging and virtual super computers, OGSA, data intensive grid service models, grid resource management and brokering; Resource management and job scheduling, grid resource monitoring with CGSP, service accounting and economy model, grid resource brokering with gridbus, software and grid computing; open source grid middleware packages, Globus toolkit architecture (gt4), containers and resource/data management, grid application trends and security measures, trust models for grid security enforcement, authentication and authorization methods, grid security infrastructure, on-line social and professional networking, online social network characteristics, graph theoretic analysis of social networks, communities and applications of social networks, facebook, the world's largest content, sharing network, twitter for micro blogging, news and alert services.

UNIT-V	INTRODUCTION TO INTELLECTUAL PROPERTY	Classes: 09

Aneka: Cloud application platform, framework overview, anatomy of the container, building of Aneka clouds, Aneka cloud programming: Thread programming, task programming and map reduce programming.

Text Books:

1. Kai Hwang, Jack Dongarra, Geoffrey Fox, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", M K Publishers, 1st Edition, 2011.
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing: Foundations and Applications Programming", Morgan Kaufmann, 1st Edition, 2011.

Reference Books:

1. Prabhu, "Grid and Cluster Compting", Prentice-Hall of India, 1st Edition, 2007.
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw Hill, 1st Edition, 2010.
3. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, "Cloud Computing Concepts, Technology and Architecture", Pearson Education, 1st Edition, 2013.
4. Pankaj Arora, Raj Biyani, Salil Dave, "To the Cloud – Cloud Powering an Enterprise", Tata Mc Graw Hill, 1st Edition, 2012.
5. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach", Tata Mc Graw Hill, 1st Edition, 2009.

Web References:

1. https://en.wikipedia.org/wiki/Cloud_computing
2. http://www.mit.edu/~caoj/pub/doc/jcao_j_gds.pdf
3. http://www.manjrasoft.com/products.html

E-Text Books:

1. https://books.google.co.in/books?id=evcgB7Qlix4C&pg=RA1-PT60&lpg=RA1 PT60&dq=1
2. https://books.google.co.in/books?id=VSDZAgAAQBAJ&pg=PR14

DISASTER MANAGEMENT

Open Elective I : AE / (CAD/CAM) / CSE / ES / SE /PEED							

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BST701	**Elective**	**L**	**T**	**P**	**C**	CIA	SEE	Total
		3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:
The student should enable the students to:
I.   Exposure to disasters, their significance and types.
II. Understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
III. Explore on Disaster Risk Reduction (DRR) approaches.
IV. Enhance awareness of institutional processes in the country.
V.   Develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT-I	INTRODUCTION TO NATURAL AND MANMADE DISASTERS	Classes: 09

Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).

UNIT-II	DISASTER, DIFFERENTIAL IMPACTS, CYCLONES AND FLOODS	Classes: 09

Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc. Differential Impacts in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change.
Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India.

UNIT-III	APPROACHES TO DISASTER RISK REDUCTION	Classes: 09

Disaster cycle, its analysis, phases, culture of safety, prevention, mitigation and preparedness community based Disaster risk reduction.

Structural, nonstructural sources, roles and responsibilities of community, Panchayati raj Institutions, Urban local bodies, states, centre and other stake holders.

UNIT-IV	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	Classes: 09

Factors affecting vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate Change Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-V	DISASTER RISK MANAGEMENT IN INDIA	Classes: 09

Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness,

OM Act and Policy, other related policies, plans, programmes and legislation).

Field work and case Studies to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the institute is located.

Text Books:

1. Nick, "Disaster Management: A Disaster Manager's Handbook", Asian Development Bank, Manila Philippines, 1991.
2. Kapur, et al., "Disasters in India: Studies of Grim Reality", Rawat Publishers, Jaipur, 2005.
3. Pelling Mark, "The Vulnerability of Cities: Natural Disaster and Social Resilience", Earthscan Publishers, London, 2003.

Reference Books:

1. Sharma, V. K. (1999), "Disaster Management", National Centre for Disaster Management, IIPE, Delhi, 1999.
2. Anil, K. Gupta and Sreeja, S. Nair (2011), "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.

Web References:

1. http://humanityroad.org/
2. http://www.wcpt.org/disaster-management/what-is-disaster-management
3. http://www.ndmindia.nic.in/
4. http://nidm.gov.in/default.asp
5. http://www.unisdr.org/2005/mdgs-drr/national-reports/India-report.pdf

Web References:

1. http://www.ekalavvya.com/disaster-management-in-india-volume-i-free-ebook/
2. http://cbse.nic.in/natural%20hazards%20&%20disaster%20management.pdf
3. http://www.undp.org/content/dam/india/docs/disaster_management_in_india.pdf
4. http://www.digitalbookindex.org/_search/search010emergencydisastera.asp

RENEWABLE ENERGY SYSTEMS

Open Elective I : AE / (CAD / CAM) / CSE / ES / SE / ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPE701	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

This course should enable the students to:

I. Illustrate the concept of photo voltaic power generation.
II. Discuss the Magneto hydrodynamic (MHD) and wind energy power conversion systems.
III. Explain tidal and wave energy.
IV. Design energy conversion systems with low impact on environment.
V. Understand the technology of fuel cells.

UNIT-I	PHOTOVOLTAIC POWER GENERATION SYSTEMS	Classes: 09

Photo voltaic power generation: spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, commercial photo voltaic systems, test specifications for PV systems, applications of super conducting materials in electrical equipment systems.

UNIT-II	MHD WIND ENERGY CONVERSION AND WIND POWER GENERATION	Classes:10

Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, MHD technology; Wind Energy conversion: Power from wind, properties of air and wind, types of wind turbines, operating characteristics.

UNIT-III	TIDAL AND WAVE ENERGY CONVERSION	Classes:08

Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.

Wave energy conversion: Properties of waves, power content, vertex motion of waves, device applications, types of ocean thermal energy conversion systems application of OTEC systems examples.

UNIT-IV	ENERGY CONVERSION SYSTEMS AND ENVIRONMENTAL EFFECTS	Classes:09

Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, co generation and energy storage, combined cycle co generation, energy storage; Global energy position and environmental effects: energy units, global energy position.

UNIT-V	FUEL CELLS	Classes:09

Fuel cells: Types of fuel cells, H_2O_2 Fuel cells, application of fuel cells, batteries, description of batteries, battery application for large power, environmental effects of energy conversion systems.

Text Books:

1. Ashok Desai V, Non-Conventional Energy, Wiley Eastern Ltd, 1990.
2. Rakosh das Begamudre, "Energy conversion systems", New age International publishers, New Delhi - 2000.
3. Freris L.L. Prentice Hall1, "Wind energy Conversion Systems", 1990.
4. Spera D.A., "Wind Turbine Technology: Fundamental concepts of wind turbine technology", ASME Press, NY, 1994.

Reference Books:

1. Mittal K.M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, 1997.
2. Ramesh R, Kurnar K.U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 1997.
3. John Twidell, Tony Weir "Renewable Energy Resources", 2nd edition.
4. Kreith, Kreider, "Solar Energy Handbook", McGrawHill

Web References:

1. http://www.nrel.gov/docs/fy13osti/54909.pdf
2. http://www.gisday.com/resources/ebooks/renewable-energy.pdf
3. http://www.geni.org/globalenergy/library/energytrends/currentusage/renewable/Renewable-Energy-Potential-for-India.pdf
4. http://www.cerien.upc.edu/jornades/jiie2005/ponencies/power%20converters%20and%20control%20of%20renewable%20energy%20systems%20paper.pdf
5. https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-SOLAR_PV.pdf

E-Text Books:

1. http://maxwell.sze.hu/~marcsa/MegujuloEnergiaforrasok/Books/renewable%20energy%20resources.pdf
2. http://lab.fs.uni-lj.si/kes/erasmus/Renewable%20Energy%20Conversion,%20Transmission,%20and%20Storage.pdf
3. http://www.landartgenerator.org/LAGI-FieldGuideRenewableEnergy-ed1.pdf

AUTOMOTIVE DESIGN

Open Elective I : AE / CSE / ES / SE / ST / PEED							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	
BCC701	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**			**Total Classes: 45**		

OBJECTIVES:
The course should enable the students to:
I.   Understand and Specify automotive styling and design principles of automotive exteriors.
II.   Analyze automotive exterior design trends.
III. Design automotive exteriors using manual and digital renderings.
IV. Create clay models of automotive exterior design.

UNIT-I	**AUTOMOTIVE DESIGN TERMINOLOGY , CLASSIFICATION OF CARS BASED ON BODY STYLE**	**Classes: 09**

Overview, Automotive design terminology, automotive design process and factors influencing automotive design, development and history behind different body styles, micro cars, hatchback and it sub types, sedan and its sub-types, coupe and its variants, convertible and its variants, station wagon, sports utility vehicles, multi utility vehicles.

UNIT-II	**PLATFORM TECHNOLOGY, TYPES OF CHASSIS, AND AUTOMOTIVE PACKAGING**	**Classes: 09**

Platform technology, types of chassis, and automotive packaging**:** Definition, motivation, versions of platform, benefits of platform sharing and downside of platform technology; History of automotive chassis, composite construction, unibody construction, tubular space frame, glass-fibre monocoque chassis, aluminium monocoque construction, carbon fibre monocoque construction, ULSAB type, definition and different layout sectors in packaging, Interior dimensions, exterior dimensions, front end (engine compartment), rear end (luggage space), under-body, major factors influencing automotive packaging, regulatory requirements.

UNIT-III	**AUTOMOTIVE FRONT- REAR END DESIGN**	**Classes: 09**

Factors affecting the front end design, front end design for better air cooling, latest design trends, bumper design theme, regulation for bumper design.

Evolution of grille design, grille design as a new brand image, hood design and new trends in exterior design, tail lamp, spoiler, bumper design, overall rear design for aerodynamics.

UNIT-IV	**AUTOMOTIVE LIGHTING SYSTEM , AUTOMOTIVE GLASSES**	**Classes: 09**

History and development in automotive lighting, different types of optical system, light sources used in lighting, headlamp design and styling, advanced lighting technology, pedestrian friendly lights, signal lamps, latest trends in automotive lighting, different types of automotive glasses, recent development in automotive glass design, importance of glass in car design, role of glazing for car safety, developments in automotive glass design.

UNIT-V	AUTOMOTIVE EXTERIOR DESIGN, PAINTING , SURFACE PROTECTION	Classes: 09

Design methodology, image boards: lifestyle board, mood board, theme board, design trends, design movements, application of design principles, product aesthetics, different types of corrosion on automotive bodies, corrosion protection methods, automotive body painting procedure, paint components and latest trends in automotive body colors.

Text Books:

1. J.Fenton, "Handbook of Automotive Body and System Design", Professional Engineering Publishing, 1st Edition, 2000.
2. Erik Eckermann, "World History of the Automobile", SAE International, 1st Edition, 2002.

Reference Books:

1. Stephen Newbury, "Car Design Year Book 1 to 5", Marrell, 1st Edition, London, 2007.
2. Tony Lewin, "How to Design Car Like A Pro", Motorbooks International, 1st Edition, 2003

Web References:

1. www.carbodydesign.com
2. www.style4cars.com
3. www.cardesignnews.com

E-Text Books:

1. http://www.sciencedirect.com/science/book/9780750656924
2. http://books.sae.org/r-312/

EMBEDDED C

Open Elective I: AE / (CAD / CAM) / CSE / SE / ST /PEED	I Semester: ES							
Course code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BES001	**Core/Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Understand embedded C and use it for programming embedded system.
II. Apply techniques for data transfer between I/O ports and memory.
III. Apply object oriented programming for designing embedded system.
IV. Use timers to generate time delays.

UNIT-I	PROGRAMMING EMBEDDED SYSTEMS IN C	Classes: 09

Introduction, what is an embedded system, which processor should you use, which programming language should you use, which operating system should you use, how do you develop embedded software, conclusions; Introduction, what's in a name, the external interface of the standard 8051, reset requirements, clock frequency and performance, memory issues, I/O pins, timers, interrupts, serial interface, power consumption, conclusions.

UNIT-II	SWITCHES	Classes: 09

Introduction, basic techniques for reading from port pins; Example: Reading and writing bytes, example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), example: counting goats, conclusions.

UNIT-III	ADDING STRUCTURE TO THE CODE	Classes: 09

Introduction, object oriented programming with C, the project header (MAIN.H), the port header (PORT.H);

Example: Restructuring the 'Hello Embedded World' example, Example: Restructuring the goat-counting example, further examples and conclusions.

UNIT-IV	MEETING REAL-TIME CONSTRAINTS	Classes: 09

Introduction, creating hardware delays using Timer 0 and Timer 1, example: Generating a precise 50 ms delay, example: Creating a portable hardware delay, Why not use Timer 2? The need for timeout mechanisms, creating loop timeouts and example: Testing loop timeouts, example: A more reliable switch interface, Creating hardware timeouts, example: Testing a hardware timeout, conclusions.

UNIT-V	CASE STUDY: INTRUDER ALARM SYSTEM	Classes: 09

Introduction, The software architecture, key software components used in this example, running the program, the software, conclusions.

Text Books:
1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.

Reference Books:
1. Nigel Gardner, "The Microchip PIC in CCS C", Ccs Inc, 2nd Revision Edition, 2002.

Web References:
1. http://www.keil.com/forum/5973/   2. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Embedded%20systems /New_index1.html   3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm   4. http://freevideolectures.com/Course/2999/Embedded-Systems-I/5

E-Text Books:
1. http://teachers.teicm.gr/kalomiros/Mtptx/e-books/eBook%20-%20PIC%20Programming%20with %20C.pdf   2. http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf   3. http://dsp-book.narod.ru/CPES.pdf   4. http://staff.ustc.edu.cn/~shizhu/WinCE/winCE6%20Fundamentals.pdf   5. http://read.pudn.com/downloads167/ebook/769402/Wrox.Professional.Microsoft.Windows.Embedd   6. ed.CE.6.0.Nov.2008.eBook-DDU.pdf   7. https://syhpullpdf.files.wordpress.com/2015/05/embedded-systems-textbook-pdf.pdf

<h1 style="text-align:center">ADVANCED JAVA PROGRAMMING AND WEB SERVICES</h1>

Open Elective I: AE / (CAD/CAM) / ES / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCS701	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the students to :

I. Understand OOPS Concepts Describe client side technologies.
II. Implement database connections.
III. Develop the skills to design user interfaces for web Applications.

UNIT-I	INTRODUCTION TO OOPs	Classes: 09

Basic concepts of OOPs: Java History, Java Features, Comparison in Java and C++ ,Java Virtual Machine, Java Environment, Program, Data types, operators, Control Structure, Classes and Objects, Constructors, Interfaces, Exception Handling.

UNIT-II	APPLETS AND SWINGS	Classes: 09

Applets: Introduction to applet, applet vs application, applet class, advantages of applet, applet lifecycle, applet tag, passing parameters to applet, types of applets, examples; swing: introduction to JFC, swing, Swing, Features, JComponent, JApplet, JFrame, JPannel, JButtons, Jcheckboxes and JRadiobuttons, JTextField, JMenu, JMenuBar

UNIT-III	HTML AND XML	Classes: 09

HTML common tags: list, tables, images, forms, frames; cascading style sheets; introduction to java scripts, objects in java script, dynamic HTML with java script.

XML: document type definition, XML schemas, document object model, presenting XML, using XML processors: DOM and SAX.

UNIT-IV	WEB SERVERS,SERVLETS AND JSP	Classes: 09

Web servers: Tomcat server installation and testing, introduction to servelets: lifecycle of a servlet, JSDK, servlet API,   javax. servlet package, reading servlet parameters, reading initialization parameters; servlets: javax, servlet HTTP package, handling http request and responses, using cookies session tracking, security issues, JSP: problem with servlet, anatomy of a JSP Page, JSP processing, JSP application design with MVC architecture, AJAX.

UNIT-V	JDBC AND ODBC	Classes: 09

JDBC & ODBC :Java and JDBC , JDBC vs ODBC, JDBC driver model, JDBC driver types, two-tier architecture for data access ,three-tier architecture for data access , types of driver managers, connecting to an ODBC data source, JDBC programs

Text Books:

1. WILEY Dreamtech Chris Bates, "Web Programming, building internet applications", 2nd edition.
2. Patrick Naughton and Herbert Schildt, "The complete Reference Java 2" , TMH, 5th Edition.
3. Hans Bergsten , "Java Server Pages", SPD O"Reilly.

Reference Books:

1. Sebesta, "Programming world wide web", Pearson Core,8th Edition 2008.
2. Marty Hall, Larry Brown, "Servlets and Javaserver Pages", Volume 1: Core Technologies, Pearson 2nd Edition 1998.

Web References:

1. http://engineeringppt.blogspot.in/2010/01/advance-java-web-technology.html
2. http://www.scoopworld.in/2015/02/ajwt-ppt-lab-materials-cse.html
3. http://jntuh.ac.in/new/bulletin_board/WEB_TECHNOLOGIES.pdf

E-Text Books:

1. http://www.freetechbooks.com/advanced-programming-for-the-java-2-platform-t36.html
2. https://www.mkyong.com/featured/top-5-free-java-ebooks/
3. http://www.e-booksdirectory.com/listing.php?category=226

INTRODUCTION TO AEROSPACE ENGINEERING

Open Elective I: (CAD/CAM) / CSE / ES / SE / ST / PEED								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BAE701	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I. Outline different aspects of flight vehicles and their operational environment.
II. Description of flow behavior of one-dimensional incompressible and compressible flow, two-dimensional flow and finite wing.
III. Apprise about boundary layer effects, aerodynamic forces on airfoils, wings and high-lift systems.
IV. Analyze airplane performance, stability and control.

UNIT-I	**INTRODUCTION TO AERONAUTICS AND ASTRONAUTICS**	**Classes: 08**

Historical perspective of aeronautics and astronautics, anatomy of the airplane, anatomy of a space vehicle, aerodynamic forces; Parameters affecting aerodynamic forces: Dimensional analysis; Theory and experiment, wind tunnels; Atmosphere: Properties of U.S. standard atmosphere, definitions of altitude.

UNIT-II	**ONE DIMENSIONAL FLOW IN INCOMPRESSIBLE AND COMPRESSIBLE FLUIDS, TWO DIMENSIONAL FLOW AND FINITE WING**	**Classes: 10**

Continuity equation, Bernoulli's equation; Application of Bernoulli's equation: Airspeed indicators and wind tunnels, one dimensional compressible flow concepts, speed of sound, compressible flow equations in a variable-area stream tube, application to airspeed measurement, applications to channels and wind tunnels; Two dimensional flow and finite wing: Limitations of one dimensional flow equations; Theory of lift: circulation, Airfoil pressure distribution, Helmholtz vortex theorems, Simulating the wing with a vortex Line, downwash, elliptic lift distribution; Lift and drag: Momentum and energy, Slope of finite wing lift curve, verification of Prandtl wing theory, additional effects of wing vortices, search for reduced induced drag.

UNIT-III	**VISCOUS EFFECTS, DRAG DETERMINATION, AIRFOILS, WINGS AND HIGH-LIFT SYSTEMS**	**Classes: 10**

Boundary layer, boundary layer on bluff bodies, creation of circulation, laminar and turbulent boundary layers: skin friction, nature of Reynolds number, effect of turbulent boundary layer on separation; Total Incompressible drag: Parasite drag, drag due to lift, importance of aspect ratio; Compressibility drag: Prediction of drag divergence Mach number, sweptback wings, total drag.

Supersonic flow: Shock waves and Mach waves, supersonic wing lift and drag, area rule, supersonic aircraft, airfoils; Wings: early airfoil development, modern airfoils, supersonic airfoils, airfoil pitching moments, effects of sweepback on lift, airfoil characteristics, airfoil selection and wing design; High-lift Devices: Airfoil maximum lift coefficient, leading and trailing edge devices, effect of sweepback, deep stall, effect of Reynolds number, propulsive lift.

UNIT-IV	**AIRPLANE PERFORMANCE, STABILITY AND CONTROL, AEROSPACE PROPULSION**	**Classes: 09**

Level flight performance, climb performance, range, endurance, energy-state approach to airplane performance, takeoff performance, landing performance; Static longitudinal stability; Dynamic longitudinal stability; Dynamic lateral stability; Control and maneuverability: Turning performance, control systems, active controls; Aerospace propulsion: Piston engines, gas turbines; Speed limitations of gas turbines: Ramjets, propellers, overall propulsion efficiency, rocket engines, rocket motor performance, propulsion-airframe integration.

UNIT-V	**AIRCRAFT STRUCTURES, HYPERSONIC FLOWS, ROCKET TRAJECTORIES AND ORBITS**	**Classes: 08**

Aircraft structures: Importance of structural weight and integrity, development of aircraft structures, importance of fatigue, materials, loads, weight estimation; Hypersonic flows: temperature effects, Newtonian theory; rocket trajectories, multistage rockets, escape velocity, circular orbital or satellite velocity, elliptical orbits, orbital maneuvers.

Text Books :

1. Richard S. Shevell, Fundamentals of Flight, Pearson Education Publication, 2nd Edition, 1988.
2. Anderson J. D, "Introduction to Flight", McGraw-Hill, 5th Edition, 1989.
3. Newman D, "Interactive Aerospace Engineering and Design", McGraw-Hill, 1st Edition, 2002.
4. Barnard R.H and Philpot. D.R, "Aircraft Flight", Pearson, 3rd Edition, 2004.

Reference Books:

1. Introduction to Flight, John D. Anderson, Jr., Tata McGraw-Hill Publishing Company, Fifth Edition, Fifth Edition, 2007.
2. Kermode, A. C, "Flight without Formulae", McGraw Hill, 4th Edition, 1997.
3. Swatton P. J, "Flight Planning", Blackwell Publisher, 6th Edition, 2002.

Web References:

1. https://fas.org/irp/doddir/army/fm3-04-203.pdf
2. http://www.aerospaceengineering.es/book/
3. http://www.ne.nasa.gov/education/
4. http://nptel.ac.in

E-Text Books:

1.http://www.e-booksdirectory.com/
2.http://www.adl.gatech.edu/extrovert/Ebooks/ebook_Intro.pdf
3.http://www.academia.edu/7950378/Introduction_to_Flight_-_Anderson_5th_Ed._

GEOSPATIAL TECHNIQUES

Open Elective-II: AE / (CAD/CAM) / CSE / ES / SE /PEED								
Course Code	**Category**	**Periods / Week**			**Credit**	**Maximum Marks**		
BST701	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I.   Provide technical skills to use geo-referenced data for the purpose of economic, educational, and social development.
II. Learn the art of image interpretation and mapping.
III. Learn the applications of geospatial technologies.

UNIT-I	INTRODUCTION TO GEOSPATIAL DATA	Classes: 09

Geospatial data, why to study geospatial data, importance of geospatial technology, spatial data infrastructure, three important geospatial technologies, spatial elements., coordinates and coordinate systems, basic electromagnetic radiation.

UNIT-II	PHOTOGRAMMETRY AND REMOTE SENSING	Classes: 10

Definition and scope, history of photogrammetry and remote sensing, principle, remote sensing data acquisition, Remote sensing data analysis methods, advantages and limitations, hardware and software required. Map Vs mosaic, ground control points. Energy interactions with atmosphere and earth surface features.

UNIT-III	MAPPING AND CARTOGRAPHY	Classes: 10

What is map and its importance, map scale and types, elements of map and Indexing, map coordinate systems, visual interpretation of satellite images, and interpretation of terrain evaluation.

Introduction to digital data analysis, cartographic symbolization, classification of symbols, colours in cartography, scale and purpose of a map, cartographic design, thematic cartography, digital cartography.

UNIT-IV	GEOGRAPHIC INFORMATION SYSTEM	Classes:10

Introduction to GIS, definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, theoretical framework for GIS, GIS data structures, data collection and input overview, processing of spatial data, data Input or output, vector data model, raster data model, geometric representation of spatial feature and data structure. Spatial data and modeling, TIN, DTM, overlay, spatial measurement etc.,

UNIT-V	GEOSPATIAL TECHNOLOGIES APPLICATIONS	Classes:09

Visual image analysis for land use / land cover mapping, land use and land cover in water resources, surface water mapping and Inventory, geological and soil mapping, agriculture applications for forestry applications, water resources applications, urban and regional planning, environmental assessment, principles of land form identification and evaluation: sedimentary, igneous and metamorphic rock terrain.

Text Books :
1.   John D. Bossler, "Manual of Geospatial Science and Technology" Taylor & Francis. 2.   M. Anji Reddy, "Textbook of Remote Sensing and Geographical Information Systems", BS Publications.

Reference Books:
1.   C. P. Lo Albert, K.W. Yonng, "Concepts and Techniques of GIS", Prentice Hall (India) Publications. 2.   Peter A Burragh and Rachael A. Mc Donnell, "Principles of Geo- Physical Information Systems", Oxford Publishers, 2004. 3.   M. Anji Reddy, "Geo-informatics for Environmental Management" BS Publications.

Web References:
1.   https://www.aaas.org/content/what-are-geospatial-technologies 2.   http://www.istl.org/10-spring/internet2.htmls

E-Text Books:
1.   http://www.springer.com/us/book/9781441900494 2.   https://www.amazon.com/Introduction-Geospatial-Technologies-Bradley-Shellito/dp/146413345X 3.   http://www.springer.com/us/book/9784431555186 4.   http://gep.frec.vt.edu/VCCS/materials/2011/Day1/Handouts/1.2-Ch.1_GIS_Intro.pdf 5.   http://www.slideshare.net/CuteGirl11/introduction-to-geospatial-technologies-pdf

SOLAR PHOTOVOLTAIC ENERGY CONVERSION

Open Elective II : AE / (CAD / CAM) / CSE / ES / SE / ST							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	
BPE702	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**			**Total Classes: 45**		

OBJECTIVES:

This course should enable the students to:
I.   Illustrate the operation of Photo voltaic power generation.
II. Analyze the characteristics of solar photovoltaic power generation.
III. Design energy conversion systems with low impact on environment.
IV. Understand the technology of fuel cells.

UNIT-I	INTRODUCTION	Classes: 09

Introduction: Highlights, an atomic description of silicon, the effect of light on silicon the potential barrier, the function of the barrier, the potential barrier in action the electric current.

UNIT-II	PHYSICAL ASPECTS OF SOLAR CELL EFFICIENCY	Classes: 09

Physical aspects of solar cell efficiency: Reflection light with too little or too much energy, recombination of electron hole pairs, direct recombination indirect recombination, resistance, self shading, performance degradation at non optimal temperatures, high temperature losses, low temperature losses.

UNIT-III	SINGLE CRYSTAL SILICON SOLAR CELLS AND ARRAYS	Classes: 09

Single Crystal Silicon Solar cells: New fabrication edge, defined film fed growth (dendritic web growth, Ribbon to ribbon (rtr) growth innovative cell designs back surface fields (BSF) and other minority carrier mirrors (MCM). Schottky barrier cells, inversion layer cells, cells for concentrated sun light advances in component technology highlights, PV building blocks, boosting voltage and amperage design requirements for connecting components, the physical connection. placing the cells;

Arrays: Array support, module covers, module cooling, hybrid designs, Brayton cycle, electricity production, the rmo electric generators, intercepting sunlight, arrays with relectors, arrays that follow the sun, controlling intensity, imaging optics, mirrors,
lenses tracking devices, steering mechanisms, tracking device controls, optimizing the use of the spectrum, splitting the spectrum, converting the spectrum to a single color.

UNIT-IV	SOLAR ARRAY CONSTRUCTIONS	Classes: 09

Solar array constructions: Intercepting sunlight, arrays with relectors, arrays that follow the sun, controlling intensity, imaging optics, mirrors, lenses; Tracking devices: steering mechanisms, tracking device controls, optimizing the use of the spectrum, splitting the spectrum, converting the spectrum to a single color.

UNIT-V	PV SUPPORT EQUIPMENT	Classes: 09

PV support equipment: PV vs conventional electricity, storing PV's electricity, batteries, fuel cells, power conditioning equipment the inverter regulators other devices; system analysis, design procedure, design constraints, other considerations.

Text Books:

1. CS Solanki, "Solar photovoltaic's fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., 2011.
2. Rai. G.D, "Solar energy utilization", Khanna publishes, 1993.
3. Rai,G.D., "Non- conventional resources of energy", Khanna publishers, Fourth edition, 2010.

Reference Books:

1. Rai. G.D, "Solar energy utilization", Khanna publishes, 1993.
2. Pai, B. R. and Ram Prasad, "Power Generation through Renewable Sources of Energy", Tata McGraw Hill, New Delhi, 1991.
3. Bansal, Kleeman and Meliss, "Renewable Energy Sources and Conversion Techniques", Tata Mc Graw Hill, 1990.
4. Godfrey Boyl, "Renewable Energy: Power sustainable future", Oxford University Press, Third edition, 2012.
5. B.H.Khan, "Non-Conventional Energy Resources", The McGraw Hills, Second edition, 2009.
6. John W Twidell and Anthony D Weir, "Renewable Energy Resources", Taylor and Francis, 2006.

Web References:

1. http://www.tue.nl/fileadmin/content/faculteiten/tn/PMP/White_papers/Delft2012_-_ALD4PV.pdf
2. http:// www.en.wikipedia.org/wiki/Photovoltaics
3. http://www.desware.net/Sample-Chapters/D06/D10-014.pdf
4. http://www.southampton.ac.uk/~solar/files/Strasbourg.pdf
5. http:// www.science.nasa.gov/science-news/science-at-nasa/2002/solarcells/

E-Text Books:

1. http://www.nrel.gov/docs/legosti/old/1448.pdf
2. http://www.irena.org/DocumentDownloads/Publications/IRENAETSAP%20Tech%20Brief%20E11%20Solar%20PV.pd
3. http://www.opalrt.com/sites/default/files/technical_papers/SOLAR%20PHOTOVOLTAIC%20ENERGY%20GENERATION%20AND%20CONVERSION.pdf

COMPUTER GRAPHICS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCC702	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the students to:

I.   Understand the basics of Computer Graphics needed for CAD/ CAM applications.
II. Apply the geometrical modeling for computer graphics.
III. Apply data structures in computer graphics.

UNIT-I	INTRODUCTION TO COMPUTER GRAPHICS	Classes: 09

Introduction: Role of computer graphics in CAD/CAM, configuration of graphic workstations, menu design and graphical user interfaces, customization and parametric programming.

UNIT-II	GEOMETRIC TRANSFORMATIONS, PROJECTIONS AND FUNDAMENTALS OF 2D AND 3D TRANSFORMATIONS	Classes: 09

Geometric transformations and projections: Vector representation of geometric entities, homogeneous coordinate systems; Fundamentals of 2D and 3D transformations: reflection, translation, rotation, scaling, and shearing, various types of projections.

UNIT-III	DEVELOPMENT OF GEOMENTRICAL MODELLING	Classes: 09

Curves: Modeling planar and space curves, analytical and synthetic approaches, non-parametric and parametric equations.

Surfaces: Modeling of bi-parametric freedom surfaces, Coons, Bezier, B-spline, and NURBS surfaces, surface manipulation techniques.

UNIT-IV	GEOMENTRICAL MODELING	Classes: 09

Geometric Modeling: Geometric modeling techniques, wireframe modeling, solid modeling: B Rep CSG, hybrid modelers, feature based, parametric and variation modeling.

UNIT-V	DATA STRUCTURES IN COMPUTER GRAPHICS	Classes: 09

Data Structure in Computer Graphics: Introduction to product data standards and data structures, data-base integration for CIM.

Text Books:

1. D. F. Rogers, J. A. Adams, "Mathematical Elements for Computer Graphics", Tata McGraw Hill. 1989.
2. I. D. Faux, M. J. Pratt, "Computational Geometry for Design and Manufacture", Ellis Horwood, 1979.
3. Mortenson, M. E., "Geometric Modeling", 3rd Ed., Industrial Press. 2006
4. Ibrahim Zeid, "CAD/CAM: Theory and Practice", Tata McGraw Hill, 1998.
5. B. K. Choi, B. K., "Surface Modeling for CAD/CAM", John Wiley & Sons 1991

Reference Books:
1.C. Pozrikidis, "Introduction to Theoretical and Computational Fluid Dynamics", Oxford University Press, 2nd Edition, 2013. 2.V. Patankar, Hema shava Suhas , " Numerical heat transfer and fluid flow", Tata McGraw Hill
Web References:
1. http://nptel.ac.in/courses/106106090/ 2. http*://*nptel.ac.in/courses/112102101/
E-Text Books:
1. http://www.freebookcentre.net/CompuScience/Free-Computer-Graphics-Books-Download.html 2.https://docs.google.com/file/d/0B_YZ665nBRhlYmNiOTU5ZDItMmU2OC00YTVmLThiNmMtMjg 3 Y2E3ZTgwZDYw/edit?hl=en_US&pref=2&pli=1

MICROCONTROLLERS FOR EMBEDDED SYSTEM DESIGN

Open Elective II: AE / (CAD / CAM) / CSE / SE / ST /PEED							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	
BES702	**Elective**	**L**	**T**	**P**	**C**	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**	

OBJECTIVES:

The course should enable the students to:

I. Understand hardware units and devices for design of embedded systems.
II. Use architectures of embedded RISC processors and system on chip processor design of embedded systems.
III. Analyze interrupt latency, context switching time, for development of device drives for timing devices.

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 09

Overview of embedded systems, processor embedded into a system, embedded hardware units and devices in system, embedded software, complex system design, design process in embedded system, formalization of system design, classification of embedded systems.

UNIT-II	MICROCONTROLLERS	Classes: 09

8051 architecture, input/output ports and circuits, external memory, counters and timers, PIC controllers; Interfacing processor 8051, PIC, memory interfacing, I/O devices, memory controller and memory arbitration schemes.

UNIT-III	EMBEDDED RISC PROCESSORS	Classes: 09

programmable system on chip architectures, continuous timer blocks, switched capacitor blocks, I/O blocks, digital blocks, programming of PSOC;

Embedded RISC processor architecture, ARM processor architecture, registers set, modes of operation and overview of Instructions.

UNIT-IV	INTERRUPTS AND DEVICE DRIVERS	Classes: 09

Exceptions and Interrupt handling Schemes, Context and periods for context switching, deadline and interrupt latency; Device driver using interrupt service routine, serial port device driver and device drivers for internal programmable timing devices.

UNIT-V	NETWORK PROTOCOLS	Classes: 09

Serial communication protocols, Ethernet protocol, SDMA, Channel and IDMA, external bus interface.

Text Books:

1. Raj Kamal, "Embedded Systems, Architecture Programming and Design", Tata Mc Graw Hill, 2nd Edition, 2008.
2. Muhammad Ali Mazidi, Rolin D. Mckinaly, Danny Causy, "PIC Microcontroller and Embedded Systems", Pearson Education, 1st Edition, 2008.
3. Robert Ashpy, "Designers Guide to the Cypress PSOC", Elsevier, 1st Edition, 2005.

Reference Books:
1. Jonathan W. Valvano – Brookes / Cole, "Embedded Microcomputer Systems, Real Time Interfacing", Thomas Learning, 1st Edition, 1998. 2. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developers Guides, Design & Optimizing System Software", Elsevier, 1st Edition, 2004. 3. John B. Peatman, "Designing with PIC Microcontrollers", PH Inc, 1st Edition, 1998.

Web References:
1. http://nptel.ac.in/syllabus/108102045/
2. http://nptel.ac.in/courses/Webcourse-contents/IIT,KANPUR/microcontrollers/micro/ui/Course_home1_1.Htm

E-Text Books:
1. http://microcontrollershop.com/default.php?cPath=239 2. http://www.sciencedirect.com/science/book/9780750667555 3. https://books.google.co.in/books/about/Embedded_Systems_Design_with_8051_Microc.html?id=YiTa,HChn0UC&redir_esc=y 4. https://books.google.co.in/books/about/Microcontroller_And_Embedded_Systems.html?id=4GrXJeC6HFkC

<h1 style="text-align:center">LINUX PROGRAMMING</h1>

Open Elective II: AE / (CAD/CAM) / ES / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCS702	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 45

OBJECTIVES:
The course should enable the students to :
I.   Understand basic Linux utilities and Shell scripting language (bash) to solve Problems.
II. Explore on implementation of Linux utilities using system calls.
III. Develop the skills necessary for systems programming
IV. Illustrate the basic skills required to write inter process communication programs.

UNIT-I	LINUX UTILITIES	Classes: 09

File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities; Sed-Scripts, Operation, Addresses, Commands, awk-Execution, Fields and Records, Scripts, Operation, Patterns, Actions, Associative Arrays, String and Mathematical functions, System commands in awk, Applications.

UNIT-II	SHELL PROGRAMMING	Classes: 09

Introduction, shell responsibilities, pipes and Redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, debugging shell scripts.

UNIT-III	FILES AND DIRECTORIES	Classes: 09

Files: File types, File System Structure, file metadata: Inodes, kernel support for files, system calls for file I/O operations: open, create, read, write, close, lseek, dup2, file status information: stat family, file and record locking: fcntl function.

File permissions - chmod, fchmod, file ownership, links: soft and hard links: symlink, link, unlink. Directories: Creating, removing and changing Directories, obtaining current working directory: getcwd, Directory contents, Scanning Directories: opendir, readdir, closedir, rewinddir functions.

UNIT-IV	INTERPROCESS COMMUNICATION AND MESSAGE QUEUES	Classes: 09

Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pies-creation, IPC between related processes using unnamed pipes, FIFOs: creation, IPC between unrelated processes using FIFOs(Named pipes), differences between unnamed and named pipes, popen and pclose library functions, Message Queues: Kernel support for messages, APIs for message queues, client/server example. Semaphores-Kernel support for semaphores, APIs for semaphores, file locking with semaphores.

UNIT-V	SHARED MEMORY AND SOCKETS	Classes: 09

Shared Memory: Kernel support for shared memory, APIs for shared memory, shared memory example, Sockets: Introduction to Berkeley Sockets, IPC over a network, Client-Server model, Socket address structures (unix domain and Internet domain), Socket system calls for connection oriented protocol and connectionless protocol.

Text Books:

1. T. Chan , "Unix System Programming using C++", PHI, 2nd Edition,2005.
2. Sumitabha Das, "Unix Concepts and Applications", 4th Edition, TMH, 2011.
3. W. R. Stevens , "Unix Network Programming", PHI, 2nd Edition ,1999.

Reference Books:

1. Mathew, R. Stones, Wrox, "Beginning Linux Programming", Wiley India Edition,4th Edition,2008.
2. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition,Pearson, 2006.
3. Hoover, "SystemProgramming with C and Unix", Pearson, 2nd Edition ,2009.
4. K. A. Robbins, "Unix System Programming, Communication, Concurrency and Threads", Pearson Education, 6th Edition, 2007.

Web References:

1. http://www.fuky.org/abicko/beginning-linux-programming.pdf
2. https://www.pdc.kth.se/about/links/linux-programming-for-beginners
3. http://www.tutorialspoint.com/unix/unix_tutorial.pdf
4. http://www.rpi.edu/dept/arc/training/shell/slides.pdf

E-Text Books:

1. http://onlinevideolecture.com/ebooks/?subject=Linux
2. http://www.onlineprogrammingbooks.com/linux-succinctly/
3. http://ebook-dl.com/item/beginning_linux_programming_4th_edition_neil_matthew_richard_stones/

RESEARCH METHODOLOGY

Open Elective II: AE / (CAD / CAM) / CSE / ES / SE / ST / PEED							

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCS703	**Elective**	**L**	**T**	**P**	**C**	CIA	SEE	Total
		3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:
The course should enable the students to:
I.   Identify an appropriate research problem in their interesting domain.
II. Organize and conduct research project.
III. Prepare a research project thesis report.
IV. Understand the law of patent and copyrights.
V.   Adequate knowledge on process for filing Patent.

UNIT-I	INTRODUCTION	Classes: 09

Definition, types of research, research approaches, research process, validity and reliability in research, features of good design, types of research design, and basic principles of experimental design.

UNIT-II	MEASUREMENT AND SCALING TECHNIQUES	Classes: 09

Errors in measurement, tests of sound measurement, scaling and scale construction techniques, forecasting techniques, time series analysis, interpolation and extrapolation.

UNIT-III	METHODS OF DATA COLLECTION	Classes: 09

Primary data, questionnaire and interviews, collection of secondary data, cases and schedules.

Professional attitude and goals, concept of excellence, ethics in science and engineering, some famous frauds in science, case studies.

UNIT-IV	INTERPRETATION OF DATA AND REPORT WRITING	Classes: 09

Layout of a research paper, techniques of interpretation, making scientific presentation at conferences and popular lectures to semi technical audience, participating in public debates on scientific issues.

UNIT-V	INTRODUCTION TO INTELLECTUAL PROPERTY	Classes: 09

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights; Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law; Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Text Books:

1. C. R. Kothari, "Research Methodology: Methods and Techniques", New Age International Publishers, 2nd Edition, 2004.
2. P. Gupta, "Statistical Methods", Sultan Chand and Sons, New Delhi, 1st Edition, 2005.
3. Richard W. Stim, "Intellectual Property: Patents, Trademarks, and Copyrights", Cengage learning, 2nd Edition, 2001.

Reference Books:

1. P. Narayana Reddy, G. V. R. K. Acharyulu, "Research Methodology and Statistical Tools", Excel Books, New Delhi, 1st Edition, 2008.
2. Prabuddha Ganguli, "Intellectual Property Right, Unleashing the Knowledge Economy", Tata Mc Graw Hill Publishing Company Ltd, 1st Edition, 2001.

Web References:

1. http://nptel.ac.in/courses/109103024/40
2. http://study.com/academy/topic/introduction-to-research-methods.html
3. https://www.vutube.edu.pk/vu-lectures/viewcategory/240/research-methods-sta630

E-Text Books:

1. http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf
2. http://www.bits-pilani.ac.in/uploads/Patent_ManualOct_25th_07.pdf
3. http://euacademic.org/BookUpload/9.pdf

INDUSTRIAL AERODYNAMICS AND WIND ENERGY

Open Elective II : (CAD/CAM) / CSE / ES / SE / ST / PEED								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BAE702	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

I.   Understand the atmospheric boundary layer and conditions.

II. Describe the wind energy and its application in turbines.

III. Familiarize with non-aeronautical uses of aerodynamics such as road vehicle, building aerodynamics and problems of flow induced vibrations.

UNIT-I	ATMOSPHERIC WINDS AND ATMOSPHERIC BOUNDARY LAYER	Classes: 08

Causes of wind thermal drive, Coriolis effect, pressure gradient effect, Geotropic winds; Land and sea breeze, mountain winds, thermals, cause of turbulence at ground level; Atmospheric boundary layer, velocity profile laws, effects of terrain on atmospheric boundary Layer; Wind tunnels basic features and components; Wind tunnel models, role of non-dimensional groups; Creation of atmospheric boundary layer type flow in a wind tunnel.

UNIT-II	WIND ENERGY	Classes: 10

Ship propulsion, sails, lift and drag translators, modern yachts; Horizontal and vertical axis wind turbines: History, first example of automatic feedback control for yaw in 16th century English windmills, classification. Horizontal axis wind turbine: Elementary actuator disc theory, Betz coefficient; Definition of power coefficient and torque coefficient for all wind turbines; Working principle, power coefficients, tip speed ratio explanation, by introductory blade element theory, conventional horizontal axis wind turbine, savonious vertical axis wind turbine, Darries vertical axis wind turbine, merits and demerits of horizontal axis wind turbines and vertical axis wind turbines.

UNIT-III	VEHICLE AERODYNAMICS	Classes: 10

Relative importance of rolling resistance and aerodynamics resistance, power requirements and drag coefficients of automobiles, notch front and notch rear wind screens versus streamlined shape, causes of vortex formation and drag, attached transverse vortex , trailing vortex, trailing vortex drag, effect of floor height on lift, effects of cut bank angle; Rear end taper.

Side panels and bottom, effects of chamfering of edges and cambering of roof and side panels; Racing cars: Traction and steering strip and use of aerofoils, high cornering seed; Commercial transport vehicles: Drag reduction on buses and tucks, driver cabin and trailer combinations.

UNIT-IV	BUILDING AERODYNAMICS	Classes: 09

Use of light weight components in modern buildings, pressure distribution on low-rise buildings, wind forces on buildings-aerodynamics of flat plate and circular cylinder , critical Reynold's no, sub -, super- & ultra critical Reynold's No. Role of wind tunnel requirements in determining shape factors (Drag coefficients) of building/structure shapes such as circular cylinder (chimneys & towers), rectangle, I-shape, L-shape, H-shape etc. vortex shedding & transverse oscillating loads. Slenderness ratio & correction factor. Special problems of tall buildings, interference effect of building.

UNIT-V	FLOW INDUCED VIBATIONS	Classes: 08

Classification: Vortex induced vibration and flow induced instability such as galloping and stall flutter; Effects of Reynolds number on wake formation of bluff shapes; Vortex induced vibration: Experimental determination of strouhal numbers for different shapes such as circular cylinder, square, rectangle, L-shape ect, universal strouhal number, unsteady Bernoulli equation, concept of added mass, resonance; Fluid-structure interaction: Effect of transverse cylinder motion on flow and wake, lock-in vortex shedding near resonant frequency, experimental evidence of cylindrical motion influencing flow and thereby reducing strength of shed vortices; Methods of suppression of vortex induced vibration; Galloping & Stall flutter: Motion of one degree-of-freedom, quasi steady flow assumption, aerodynamic damping; Galloping: Force in the direction of plunging (transverse motion) and positive force coefficient, critical speed, galloping of transmission wire with winter ice, stall flutter of airfoils.

Text Books :

1. Siraj Ahmed, "Wind Energy theory and practice", PHI learning Pvt Ltd., 3rd Edition, 2015.
2. R. D. Blevins, "Flow Induced Vibrations", Van Nostard, 2nd Edition, 1990.
3. P. Sachs, "Wind Forces in Engineering", Pergamon press, 2nd Edition, 1988.
4. N. G. Calvert, "Wind Power Principles", Charles Griffin & co. London, 1st Edition, 1979.

Reference Books:

1. R. S. Scorer, "Environmental Aerodynamics", Ellis Harword Ltd, England, 1st Edition, 1978.
2. M. Sorvan, "Aerodynamics Drag Mechanisms of Bluff Bodies and Road vehicles", plenum press, 2nd Edition, 1978.

Web References:

1. http://www.mech.canterbury.ac.nz/research/fluid%20mechanics.shtml
2. http://www.journals.elsevier.com/journal-of-wind-engineering-and-industrial-aerodynamics

E-Text Books:

1. http://www.sciencedirect.com/science/journal/01676105
2. https://www.scribd.com/doc/42602999/Flow-Induced-Vibration-by-Robert-D-Blevins-2nd-Ed
3. http://store.elsevier.com/Wind-Forces-in-Engineering/Peter-Sachs/isbn-9781483148359/

VISION AND MISSION OF THE INSTITUTE

VISION

To bring forth professionally competent and socially sensitive engineers, capable of working across cultures meeting the global standards ethically.

MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

M.TECH - PROGRAM OUTCOMES (PO's)

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences (**Problem Analysis**).

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**).

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**).

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 (**Modern Tool Usage**).

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**).

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**).

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice (**Ethics**).

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings (**Individual and Team Work**).

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**).

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: 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**).

OBJECTIVES OF THE DEPARTMENT

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

Program Educational Objectives (PEO's)

A graduate of the Computer Science and Engineering Program should:

PEO – I: Students will establish themselves as effective professionals by solving real problems through the use of computer science knowledge and with attention to team work, effective communication, critical thinking and problem solving skills.

PEO – II: Students will develop professional skills that prepare them for immediate employment and for life-long learning in advanced areas of computer science and related fields.

PEO – III: Students will demonstrate their ability to adapt to a rapidly changing environment by having learned and applied new skills and new technologies.

PEO – IV: Students will be provided with an educational foundation that prepares them for excellence, leadership roles along diverse career paths with encouragement to professional ethics and active participation needed for a successful career.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO – I: **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.

PSO – II: **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.

PSO – III: **Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. **Who grants Autonomy? UGC, Govt., AICTE or University**
   In case of Institutes affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Institutes.

2. **Shall IARE award its own Degrees?**
   No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3. **What is the difference between a Deemed University and an Autonomy Institute?**
   A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous Institute enjoys Academic Autonomy alone. The University to which an autonomous institute is affiliated will have checks on the performance of the autonomous institute.

4. **How will the Foreign Universities or other stake – holders know that we are an Autonomous Institute?**
   Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Telangana mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5. **What is the change of Status for Students and Teachers if we become Autonomous?**
   An autonomous institute carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6. **Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?**
   There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7. **Will the students of IARE as an Autonomous Institute qualify for University Medals and Prizes for academic excellence?**
   No. IARE has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8. **Can IARE have its own Convocation?**
   No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at IARE.

9. **Can IARE give a provisional degree certificate?**
   Since the examinations are conducted by IARE and the results are also declared by IARE, the institute sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore with the prior permission of the University the institute will be entitled to give the provisional certificate.

10. **Will Academic Autonomy make a positive impact on the Placements or Employability?**
Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous institute will therefore represent better employability.

11. **What is the proportion of Internal and External Assessment as an Autonomous Institute?**
Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12. **Is it possible to complete Internal Assessment for Theory or Practicals?**
Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13. **Why Credit based Grade System?**
The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14. **What exactly is a Credit based Grade System?**
The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like A, B, C, D etc. are assigned for a range of Marks. (e.g. 91% and above is A+, 80 to 90 % could be A etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15. **What are the norms for the number of Credits per Semester and total number of Credits for UG/PG programme?**
These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16. **What is a Semester Grade Point Average (SGPA)?**
The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n}\left(C_i\, G_i\right)/\sum_{i=1}^{n}C_i$$

Where, C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17. **What is a Cumulative Grade Point Average (CGPA)?**
An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{n}(C_i \, S_i)\,/\sum_{j=1}^{n} C_i$$

Where, S_i is the SGPA of the ith semester and C_i is the total number of credits in that semester and j represent the number of courses in which a student's is registered upto the semester. CGPA is rounded to two decimal places.

18. **Is there any Software available for calculating Grade point averages and converting the same into Grades?**
Yes, The institute has its own MIS software for calculation of SGPA, CGPA, etc.

19. **Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?**
No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20. **Will there be any Revaluation or Re-Examination System?**
No. There will double valuation of answer scripts. There will be a makeup Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21. **How fast Syllabi can be and should be changed?**
Autonomy allows us the freedom to change the syllabi as often as we need.

22. **Will the Degree be awarded on the basis of only final year performance?**
No. The CGPA will reflect the average performance of all the semester taken together.

23. **What are Statutory Academic Bodies?**
Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in everybody is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24. **Who takes Decisions on Academic matters?**
The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25. **What is the role of Examination committee?**
The Examinations Committee is responsible for the smooth conduct of internal, End Semester and make up Examinations. All matters involving the conduct of examinations, spot valuations, tabulations and preparation of Grade Cards etc fall within the duties of the Examination Committee.

26. **Is there any mechanism for Grievance Redressal?**
The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27. **How many attempts are permitted for obtaining a Degree?**
All such matters are defined in Rules & Regulation

28. **Who declares the result?**

The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29. **Who will keep the Student Academic Records, University or IARE?**

It is the responsibility of the Dean, Academics of the Autonomous Institute to keep and preserve all the records.

30. **What is our relationship with the JNT University?**

We remain an affiliated institute of the JNT University. The University has the right to nominate its members on the academic bodies of the institute.

31. **Shall we require University approval if we want to start any New Courses?**

Yes, It is expected that approvals or such other matters from an autonomous institute will receive priority.

32. **Shall we get autonomy for PG and Doctoral Programmes also?**

Yes, presently our PG programs also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred

		and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

UNDERTAKING BY STUDENT / PARENT

"To make the students attend the classes regularly from the first day of starting of classes and be aware of the Institute regulations, the following Undertaking Form is introduced which should be signed by both student and parent. The same should be submitted to the Dean, Academic".

I, Mr./Ms. -- joining I Semester for the academic year 2016-2017 in Institute of Aeronautical Engineering, Hyderabad, do hereby undertake and abide by the following terms, and I will bring the ACKNOWLEDGEMENT duly signed by me and my parent and submit it to the Dean, Academic.

1. I will attend all the classes as per the timetable from the starting day of the semester specified in the institute Academic Calendar. In case, I do not turn up even after two weeks of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (theory/practical/drawing) and secure attendance of not less than 80% in every course as stipulated by Institute. I am fully aware that an attendance of less than 70% in more than three courses will make me lose one year.
3. I will compulsorily follow the dress code prescribed by the institute.
4. I will conduct myself in a highly disciplined and decent manner both inside the classroom and on campus, failing which suitable action may be taken against me as per the rules and regulations of the institute.
5. I will concentrate on my studies without wasting time in the Campus/Hostel/Residence and attend all the tests to secure more than the minimum prescribed Class/Sessional Marks in each course. I will submit the assignments given in time to improve my performance.
6. I will not use Mobile Phone in the institute premises and also, I will not involve in any form of ragging inside or outside the campus. I am fully aware that using mobile phone to the institute premises is not permissible and involving in Ragging is an offence and punishable as per JNTUH/UGC rules and the law.
7. I declare that I shall not indulge in ragging, eve-teasing, smoking, consuming alcohol drug abuse or any other anti-social activity in the institute premises, hostel, on educational tours, industrial visits or elsewhere.
8. I will pay tuition fees, examination fees and any other dues within the stipulated time as required by the Institution / authorities, failing which I will not be permitted to attend the classes.
9. I will not cause or involve in any sort of violence or disturbance both within and outside the institute campus.
10. If I absent myself continuously for 3 days, my parents will have to meet the HOD concerned/ Principal.
11. I hereby acknowledge that I have received a copy of IARE - R16 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

ACKNOWLEDGEMENT

I have carefully gone through the terms of the undertaking mentioned above and I understand that following these are for my/his/her own benefit and improvement. I also understand that if I/he/she fail to comply with these terms, shall be liable for suitable action as per Institute/JNTUH/AICTE/UGC rules and the law. I undertake that I/he/she will strictly follow the above terms.

Signature of Student with Date

Signature of Parent with Date
Name & Address with Phone Number