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 CATALOG AND SYLLABI
PG21

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2021 - 2022)

These rules and regulations may be altered/changed from time to time by the academic council
FAILURE TO READ AND UNDERSTAND THE RULES IS NOT AN EXCUSE

INSTITUTE VISION | MISSION | QUALITY POLICY

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.

QUALITY POLICY

Our policy is to nurture and build diligent and dedicated community of engineers providing a professional and unprejudiced environment, thus justifying the purpose of teaching and satisfying the stake holders.

A team of well qualified and experienced professionals ensure quality education with its practical application in all areas of the Institute.

DEPARTMENT VISION | MISSION

VISION

The Vision of the department is to produce competent graduates suitable for industries and organizations at global level including research and development with Social responsibility.

MISSION

To provide an open environment to foster professional and personal growth with a strong theoretical and practical background having an emphasis on hardware and software development making the graduates industry ready with social ethics.

Further the Department is to provide training and to partner with Global entities in education and research.

M.TECH - PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

The students of M. Tech Computer Science and Engineering are prepared to:

PEO - I	Independently design and develop computer software systems and products based on sound theoretical principles and appropriate software development skills.
PEO - II	Demonstrate knowledge of technological advances through active participation in life-long learning.
PEO - III	Accept to take up responsibilities upon employment in the areas of teaching, research, and software development.
PEO - IV	Apply advanced-level knowledge, techniques, skills, and modern tools in the field of computer scienceand engineering and its allied areas for solving real-time problems.

M.TECH - PROGRAM OUTCOMES (PO's)

Upon completion of M.Tech Degree, the students will be able to:

PO - 1	Independently carry out research/investigation and development work to solve practical problems
PO - 2	Write and present a substantial technical report/document
PO - 3	Demonstrate a degree of mastery in computer science and engineering emerging areas such as datascience, cyber security, and application development
PO - 4	Apply advanced-level knowledge, techniques, skills, and modern tools in the field of computer scienceand engineering and its allied areas for solving real-time problems.
PO - 5	Function effectively in multidisciplinary environments with the knowledge of frontier technologies byworking cooperatively, creatively, and responsively as a member or leader in diverse teams.
PO - 6	Engage in life-long learning for continuing education in doctoral-level studies and professionaldevelopment.

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 updation 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 "PG21" 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 college. 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 college, 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 college 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 2021 - 22)

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 /mini project work with seminar/ viva / seminars / 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 program will be placed in one of the 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	Electrical Power Systems	Electrical and Electronics Engineering	PS
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	Aerospace Engineering	Aeronautical Engineering	AE

5.0 TYPES OF COURSES

Courses in a program may be of four kinds: **Core, Elective, Open and Audit.**

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 program 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.

There shall be five professional core 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.

5.3 Open Elective Course:

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

5.4 Audit Course:

The value added courses are audit courses offered through joint ventures with various organizations providing ample Scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen fields of study. A plenty of value added programs will be proposed by the departments one week before the commencement of class work. The students are given the option to choose the courses according to their desires and inclinations as they choose the desired items in a cafeteria. The expertise gained through the value added programs should enable them to face the formidable challenges of the future and also assist them in exploring new opportunities. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

6.0 SEMESTER STRUCTURE

The Institute shall follow semester pattern. An academic year shall consist of two semesters. Each semester shall be of 23 weeks' 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. The duration for each semester shall be a minimum of 17 weeks of instruction. The Academic calendar shall be declared at the beginning of the academic year as shown 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 and Supplementary Exams			4 weeks
THIRD SEMESTER	I Spell Instruction Period	9 weeks	19 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Project Work Phase - I		
	Semester End Examinations		1 week
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 he/she 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 CGPA ≥ 6.0, and shall pass all the mandatory Audit Courses to complete the M.Tech program successfully.

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.

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8.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Core Courses, Professional core elective courses, Audit courses, Open elective courses, Laboratory courses, Mini project with seminar, Project work-1 and Project work-2.

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 2 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	Professional Core Elective Courses	3	3
3	Audit Courses	2	0
4	Laboratory Courses	4	2
5	Open Elective Courses	3	3
6	Mini Project with Seminar	2	2
7	Project Work-1 Dissertation	20	10
8	Project Work-2 Dissertation	32	16

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Core Courses (04)+Professional Core Electives (05) + Open Electives (01)	04@3credits + 05 @ 3 credits + 01@3 credits	30
Total Laboratory Courses (04)	04@2credits	08
Mini Project with Seminar(01)	1@2credit	02
Research Methodology and IPR	1@2 credit	02
Project Work-1	1 @10credit	10
Project Work-2	1 @16credits	16
TOTAL CREDITS		**68**

9.0 EVALUATION METHODOLOGY

9.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE).

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. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). **Two CIE Tests are Compulsory** and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty.

Table 4: Assessment pattern for Theory Courses

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

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Examination.

Assignment:

To improve the writing skills in the course an assignment will be evaluated for 05 marks. One assignment has to submit at the end of the CIE2 for the questions provided by the each course coordinator in that semester. Assignments to be handed in as loose paper collection stapled together at the top left corner. The assignment should be presented as a professional report. It must consist of a cover sheet, content page, and should have an introduction, a body, a conclusion or recommendation, and a reference page.

Alternative Assessment Tool (AAT):

In order to encourage innovative methods while delivering a course, the faculty members are encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning center. **The AAT may includes, concept videos, course related term paper, technical seminar, term paper, paper presentations conducted by reputed organizations relevant to the course etc.**

9.2 Laboratory Course:

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.

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 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.

9.3.1 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.

9.3.2 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.

9.3.3 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**

9.3.4 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).

9.3.5 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.

9.3.6 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.

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 75% 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 10% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the Department if his/her attendance is between 75% to 65% 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.

10.4 However, in case of a student having less than 65% attendance in any course, s/he shall be detained in the course and in no case such process will be relaxed.

10.5 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.

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

10.7 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.

10.8 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 / Project, if s/he secures

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

ii. A minimum of 50% marks for each Laboratory / Mini project with Seminar / 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 10point grading system with the following letter grades as given below:

Range of Marks	Grade Point	Letter Grade
90% and above (≥90% , ≤ 100%)	10	S (Superior)
Below 90% but not less than 80% (≥80% , <90%)	9	A+ (Excellent)
Below 80% but not less than 70% (≥70% , <80%)	8	A (Very Good)
Below 70% but not less than 60% (≥60% , <70%)	7	B+ (Good)
Below 60% but not less than 50% (≥50% , <60%)	6	B (Average)
Below 50% (<50%)	0	F (Fail)
Absent	0	AB (Absent)

13.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: "S", "A+", "A", "B+", "B".

13.3 A student obtaining Grade "F" shall be considered Failed and will be required to reappear in the examination.

13.4 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 tocompute 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 i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student's 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 j^{th} 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	4	A	8	4 x 8 = 32
Course 2	4	S	10	4 x 10 = 40
Course 3	4	B	6	4 x 6 = 24
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B	6	3 x 6 = 18
	21			**159**

Thus, SGPA = 159 / 21 = 7.57

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credits: 24 SGPA: 7	Credits: 24 SGPA: 6	Credits: 24 SGPA: 6.5	Credits: 24 SGPA: 6

Thus, $CGPA = \dfrac{24x7 + 24x6 + 24x6.5 + 24x6 = 6.37}{96}$

16.0 REVALUATION

If the examinee is not satisfied with the marks awarded, he/she may apply for revaluation of answer book in prescribed format online within three (3) working days from the date of declaration of result of the examination or issue of the statement of marks, whichever is earlier. The revaluation facility shall be for theory papers only. The revaluation of answer book shall not be permitted in respect of the marks awarded to the scripts of practical examination / project work (including theory part) and in viva voce / oral / comprehensive examinations.

The revaluation will be done by a second independent examiner. The result after revaluation shall be as follows:

- The revaluation marks are considered only if the difference between the original award and award on revaluation is more than equal to 15% of 70 marks (11 marks).
- If the difference between the original award and the award on reevaluation is more than 20% (14 marks), a third evaluator is to be appointed and the average of two nearest awards (in the range of 15%) shall be considered.

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 68 credits.

17.2 A Student who fails to earn 68 credits as per the specified course catalogue, and as indicated above, within four academic years from the date of commencement of his first year first semester, shall forfeit his/her seat in M. Tech. program and his admission shall stand cancelled.

18.0 AWARD OF DEGREE

After a student has earned the requirements prescribed for the completion of the program and is eligible for the award of M.Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

Class Awarded	CGPA
First Class with Distinction	≥ 7.75
First Class	$6.75 \leq$ CGPA < 7.75
Second Class	$6.00 \leq$ CGPA < 6.75

A student with final CGPA (at the end of the M.Tech program) < 6.00 shall not be eligible for the Award of Degree.

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

19.0 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.

20.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the college / 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.

21.0 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.

22.0 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.

23.0 TRANSITORY REGULATIONS

23.1 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.

23.2 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.

24.0 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 AERONAUTICALENGINEERING
(AUTONOMOUS)

COMPUTER SCIENCE AND ENGINEERING

COURSE CATALOG – PG21

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										
BCSC01	Mathematical Foundations of Computer Science	PCC	Core	3	0	0	3	30	70	100
BCSC02	Advanced Data Structures	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective-I	PCE	Elective	3	0	0	3	30	70	100
	Professional Core Elective-II	PCE	Elective	3	0	0	3	30	70	100
	Audit Course	Audit - I	Audit	2	0	0	0	30	70	100
PRACTICAL										
BCSC11	Advanced Data Structures Laboratory	PCC	Core	0	0	4	2	30	70	100
BCSC12	Data Science Laboratory	PCC	Core	0	0	4	2	30	70	100
TOTAL				**14**	**00**	**08**	**16**	**210**	**490**	**700**

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										
BCSC13	Cyber Security	PCC	Core	3	0	0	3	30	70	100
BCSC14	Soft Computing	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective-III	PCE	Elective	3	0	0	3	30	70	100
	Professional Core Elective-IV	PCE	Elective	3	0	0	3	30	70	100
	Audit Course	Audit - II	Audit	2	0	0	0	30	70	100
PRACTICAL										
BCSC23	Soft Computing Laboratory	PCC	Core	0	0	4	2	30	70	100
BCSC24	Cyber Security Laboratory	PCC	Core	0	0	4	2	30	70	100
BCSC25	Mini Project with Seminar	PCC	Core	0	0	4	2	30	70	100
TOTAL				**14**	**00**	**12**	**18**	**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										
BHSC11	Research Methodology and IPR	PCC	Core	2	0	0	2	30	70	100
	Professional Core Elective – V	PCE	Elective	3	0	0	3	30	70	100
	Open Elective Courses	OEC	Elective	3	0	0	3	30	70	100
PROJECT										
BCSC31	Phase-I Dissertation	Major Project	Core	0	0	20	10	30	70	100
TOTAL				**08**	**00**	**20**	**18**	**120**	**280**	**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
BCSC32	Phase-II Dissertation	Major Project	Core	0	0	32	16	30	70	100
TOTAL				**00**	**00**	**32**	**16**	**30**	**70**	**100**

PROFESSIONAL CORE ELECTIVE COURSES

PROFESSIONAL COREELECTIVE – I

Course Code	Course Title
BCSC03	Machine Learning
BCSC04	Wireless Sensor Networks
BCSC05	Deep Learning
BCSC06	High Performance Computing

PROFESSIONAL COREELECTIVE – II

Course Code	Course Title
BCSC07	Data Science
BCSC08	Distributed Systems
BCSC09	Mining Massive Datasets
BCSC10	Web and Database Security

PROFESSIONAL CORE ELECTIVE –III

Course Code	Course Title
BCSC15	Data Preparation and Analysis
BCSC16	Secure Software Design & Enterprise Computing
BCSC17	Computer Vision
BCSC18	Cloud Computing

PROFESSIONAL CORE ELECTIVE –IV

Course Code	Course Title
BCSC19	Internet of Things and Applications
BCSC20	GPU Computing
BCSC21	Digital Forensics
BCSC22	Big Data Analytics

PROFESSIONAL CORE ELECTIVE – V

Course Code	Course Title
BCSC26	Mobile Applications and Services
BCSC27	Advanced Algorithms
BCSC28	Optimization Techniques
BCSC29	Mobile Application Development

OPEN ELECTIVE COURSES

Course Code	Course Title
BAEC30	Elements of Aerospace Engineering
BCSC30	Data Analytics
BESC30	Real Time Operating Systems
BPSC30	Waste to Energy
BCCC30	Operations Research
BSTC30	Project Management and Planning

AUDIT COURSES

Course Code	Course Title
BHSC01	English for Research Paper Writing
BHSC02	Disaster Management
BHSC03	Sanskrit for Technical Knowledge
BHSC04	Value Education
BHSC05	Constitution of India
BHSC06	Pedagogy Studies
BHSC07	Stress Management by Yoga
BHSC08	Personality Development through Life Enlightenment Skills
BHSC09	Business Sustainability and Management
BHSC10	Business Ethics and Corporate Governance

SYLLABUS
(I – III SEMESTERS)

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

I Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC01	Core	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course will discuss fundamental concepts in mathematics with emphasis on their applications to computer science. Topics include probability, distribution, multivariant statistical models, computer applications, trees and graphs. This course is appropriate for communications and networking, storage and retrieval of information.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The mathematical fundamentals that are prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
II. The mathematical and logical basis to many modern techniques in information technology.
III. Gain knowledge about various sampling and classification problems.

III. COURSE OUTCOMES:

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

CO1	**Make use of** probability theory and distributions for depicting the expected outcome of possible values in the data generating process/experiment.	Understand
CO2	**Build** statistical models based on random sampling data for getting unbiased estimates in performing data analysis.	Understand
CO3	**Examine** regression and multivariate statistical models for solving classification and curve fitting problems in data analysis.	Apply
CO4	**Identify** appropriate techniques of graphs and combinatorial theory for finding solutions to shortest path and enumeration problems.	Apply
CO5	**Choose** appropriate mathematical and statistical techniques for solving applications in emerging areas of Information Technology.	Apply

IV. SYLLABUS

MODULE-I: INTRODUCTION (10)

Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains.

MODULE-II: RANDOM SAMPLES (10)

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.

MODULE-III: STATISTICAL INTERFACE (8)

Statistical inference, Introduction to multivariate statistical models: regression and classification problems,
principal components analysis, The problem of over fitting model assessment.

MODULE-IV: GRAPH THEORY (09)

Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

MODULE-V: COMPUTER SCIENCE AND ENGINEERING APPLICATIONS (08)

Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

V. TEXT BOOKS:

1. John Vince, "Foundation Mathematics for Computer Science", Springer 2015.
2. K. Trivedi. "Probability and Statistics with Reliability, Queuing, and Computer Science Applications". Wiley, 2016.
3. M. Mitzenmacher and E. Upfal." Probability and Computing: Randomized Algorithms and Probabilistic Analysis". Wiley, 2005.

VI. Reference Books:

1. Alan Tucker, "Applied Combinatorics", Wiley, 2012.

VII. 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.

VIII. 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.

ADVANCED DATA STRUCTURES

I Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC02	Core	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course covers some of the general-purpose data structures and algorithms in software development phases. Topics covered include managing complexity, analysis, static data structures, dynamic data structures and hashing mechanisms. The course is to teach the students how to select and design data structures and algorithms that are appropriate for problems that they might encounter in problem solving in mathematical and engineering areas.

II. COURSE OBJECTIVES:

The students will try to learn:

1. The performance trade-offs of different algorithms / implementations and asymptotic analysis of their running time and memory usage.
2. The knowledge of basic abstract data types (ADT) and associated algorithms to perform various operations on different types of data structures.
3. The fundamentals of how to store, retrieve, and process the data efficiently.

III. COURSE OUTCOMES:

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

CO1	**Analyze** the performance and complexity of the algorithms on data structures and their applications using mathematical tools like asymptotic notations.	Understand
CO2	**Construct** complex data structures for processing, organizing, and accessing information	Understand
CO3	**Design** and Implement non-linear data structures using trees and graphs.	Understand
CO4	**Organize** data in the form of trees and graphs for retrieving information effectively.	Apply
CO5	**Model** the real-world data using red black and splay trees for comparison of text, patterns, and querying.	Understand

MODULE-I: OVERVIEW OF DATA STRUCTURES (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 nonlinear 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 linkedlist.

MODULE-II: DICTIONARIES, HASH TABLES (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.

MODULE-III: TREES AND GRAPHS (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.

MODULE-IV: SEARCH TREES I (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.

MODULE-V: SEARCH TREES II (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.

V TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", Universities Press Private Limited, India, 2nd Edition, 2008.
2. G.A.V.Pai, "Data Structures and Algorithms",Tata McGraw Hill, NewDelhi,1stEdition,2008.
3. M. A. Weiss, Addison Wesley, "Data Structures and Algorithm Analysis in Java", Pearson Education, 2nd Edition, 2005.

VI. REFERENCE BOOKS:

1. D. Samanta, "Classic Data Structures", Prentice Hall of India Private Limited, 2nd Edition, 2003.
2. Aho, Hop craft, 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, 3rdEdition, 2011.

VII 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

VIII E-TEXT BOOKS:

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

MACHINE LEARNING

I Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC03	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Machine learning is all about automatically learning a highly accurate predictive or classifier model, or finding unknown patterns in data, by leveraging learning algorithms and optimization techniques. Applications of machine learning includes image recognition, speech recognition, traffic prediction, product recommendations, email spam etc.

II. COURSE OBJECTIVES:

The students will try to learn:

1. Learn the concept of how to learn patterns and concepts from data without being explicitly programmed.
2. Design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. Explore Deep learning technique and various feature extraction strategies.

III. COURSEOUTCOMES:

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

CO 1	**Make use of** the basic methods of supervised learning with linear models and binary classification included in multi-class outputs.	Understand
CO 2	**Summarize** decision trees, support vector machines in optimizing basic methods of regression	Understand
CO 3	**Sketch** the key issues and applications in clustering and dimensionality reduction.	Apply
CO 4	**Experiment** matrix factorization used to process reduction in unsupervised learning.	Apply
CO 5	**Develop** algorithms in optimizing statistical learning theory and methods in machine learning.	Apply

IV. SYLLABUS

MODULE-I: SUPERVISED LEARNING (REGRESSION/CLASSIFICATION) (10)

Basic methods: Distance-based methods, Nearest- Neighbors, Decision Trees, Naive Bayes, **Linear models:** Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, **Beyond Binary Classification:** Multi-class/Structured Outputs, Ranking.

MODULE-II: UNSUPERVISED LEARNING (10)

Clustering: K-means/Kernel K-means, **Dimensionality Reduction:** PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models).

MODULE-III: MACHINE LEARNING (08)

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests).

MODULE-IV: MODELLING TECHNIQUES (09)

Sparse Modelling and Estimation, Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

MODULE-V: SCALABLE MACHINE LEARNING (08)

A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference

V. TEXT BOOKS:

1. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer 2009 (freely available to online).

VI. REFERENCE BOOKS:

1. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.

VII. 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.

VIII 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.

WIRELESS SENSOR NETWORKS

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC04	**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**		

I. COURSE OVERVIEW:

Wireless sensor networks are self-configured and infrastructure, fewer wireless networks to monitor physical or environmental conditions such as temperature, sound, vibration. Sensor nodes are used in WSN with the onboard processor that manages and monitors the environment in a particular area. It includes network simulator, access control protocol designs, routing protocols, security. Applications of WSN are precision agriculture, healthcare and smart cities.

II. COURSE OBJECTIVES:

The students will try to learn:

1. Architect sensor networks for various application setups.
2. Devise appropriate data dissemination protocols and model links cost.
3. Understandings of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
4. Evaluate the performance of sensor networks and identify bottlenecks.

III. COURSE OUTCOMES:

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

CO 1	**Summarize** a wireless sensor network design parameters for given sensor data using microcontroller, transceiver, middleware and operating system.	Understand
CO 2	**Categorize** the performance of schedule based and random Medium Access Control protocols in terms of power consumption, fairness, channel utilization and control packet overhead.	Analyze
CO 3	**Identify** the appropriate geographic routing protocols for improving the performance in terms of power consumption, scalability and latency parameters.	Apply
CO 4	**Evaluate** the performance of transport control protocols in terms of congestion detection and avoidance, reliability and control packet overhead parameters.	Evaluate
CO 5	**Distinguish** the design issues and different categories of MAC protocols	Analyze

IV. SYLLABUS:

MODULE-I: INTRODUCTION TO WIRELESS SENSOR NETWORKING (09)

Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors.

Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture.

Hardware Platforms: Motes, Hardware parameters.

MODULE-II: INTRODUCTION TO NS-3 (09)

Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation.

MODULE-III: MEDIUM ACCESS CONTROL PROTOCOL DESIGN (09)

Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled
Introduction to Markov Chain: Discrete time Markov Chain definition, properties, classification and analysis.

MAC Protocol Analysis: Asynchronous duty-cycled. X-MAC Analysis (Markov Chain).

MODULE-IV: SECURITY(09)

Possible attacks, countermeasures, SPINS, Static and dynamic key distribution.

MODULE-V: ROUTING PROTOCOLS (09)

Routing protocols: Introduction, MANET protocols
Routing protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast. Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks.

V TEXT BOOKS:

1. W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory and Practice", Wiley2010.
2. Kazem Sohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks -Technology, Protocols, and Applications", Wiley Inter science, 2007.
3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", Springer, 2010.

VI. REFERENCE BOOKS:

1. KamiloFeher, "Wireless Digital Communications", PHI, 1st Edition, 1999.
2. Kaveh PahLaven, P. Krishna Murthy, "Principles of Wireless Networks", Prentice Hall PTR, 1st Edition,2002
3. AndreawsF. Molisch, "Wireless Communications", Wiley India, 2nd Edition, 2006.

VII. 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

VIII. E-TEXT BOOKS:

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

DEEP LEARNING

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC05	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course will discuss fundamental concepts in deep learning with emphasis on their applications to computer science. Topics include various search algorithms conventional neural networks, applications of deep learning to computer vision, applications of deep learning to NLP and analogy reasoning.

II. OBJECTIVES:

The students will try to learn:

I The complexity of Deep Learning algorithms and their limitations

II The Capable of performing experiments in Deep Learning using real-world data.

III. COURSE OUTCOMES:

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

CO 1	Implement deep learning algorithms, understand neural networks and traverse the layers ofdata	**Apply**
CO 2	Learn topics such as convolutional neural networks, recurrent neural networks, training deepnetworks and high-level interfaces	**Apply**
CO 3	Understand applications of Deep Learning to Computer Vision	**Understand**
CO 4	Understand and analyze Applications of Deep Learning to NLP	**Understand**
CO 5	Analyze and implement deep learning networks in real time applications	**Analyze**

IV. SYLLABUS:

MODULE-I: INTRODUCTION (09)

Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

MODULE-II: CONVOLUTIONAL NEURAL NETWORKS (08)

Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

MODULE-III: APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION (10)

Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text withLSTM models, Attention Models for computer vision tasks

MODULE-IV: APPLICATIONS OF DEEP LEARNING TO NLP (09)

Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Wordsmodel (CBOW), Glove, Evaluations and Applications in word similarity.

MODULE-IV: APPLICATIONS OF DEEP LEARNING TO NLP (09)

Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs.

V. TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

VI. REFERENCE BOOKS:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

HIGH PERFORMANCE COMPUTING

I Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC06	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

High performance computing is to give solid foundations for developing, analyzing, and implementing parallel and locality-efficient algorithms. This course focuses on theoretical underpinnings. To give a practical feeling for how algorithms map to and behave on real systems, we will supplement algorithmic theory with hands-on exercises on modern HPC systems, such as Cilk Plus or OpenMP on shared memory nodes, CUDA for graphics co-processors (GPUs), and MPI and PGAS models for distributed memory systems.

II. COURSE OBJECTIVES:

The students will try to learn:

1. Understand the fundamental principles in design and programming of parallel algorithms.
2. Study the approaches to achieve high performance models in real time applications.
3. Explore on parallel computing development tools and technologies.
4. Illustrate on add on tools to address the performance issues, analysis, data transformation and visualization.

III. COURSE OUTCOMES:

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

CO 1	**Make use of** GPU programming for running Highly Parallel general purpose competitions in 2-Dimensional and 3-Dimensional thread mapping.	Create
CO 2	**Identify** different types of memories used in GPUs for performance evaluation for a specific application.	Apply
CO 3	**Develop** a GPU program for usage of concurrent data structures applied in different types of functions.	Evaluate
CO 4	**Make use of** stream processing techniques used in GPUs in applications of weather modeling & medical applications.	Apply
CO 5	**Develop** a GPU program in application of image processing, graph algorithms & deep learning.	Knowledge

IV. SYLLABUS:

MODULE-I: DESIGN OF PARALLEL ALGORITHMS (10)

Parallel computers and computation, a parallel machine model, a parallel programming model, parallel algorithm examples, partitioning, communication, agglomeration, mapping, load balancing algorithms, task, scheduling algorithms, case studies, random numbers generation, hypercube algorithms, vector reduction, matrix transposition, merge sort.

MODULE-II: APPROACHES TO PERFORMANCE MODELING (10)

A quantitative basis for design, defining performance, approaches to performance modeling, developing models, performance parameters, time, scalability, overheads, bandwidth, efficiency, speed, interconnection networks, input/output; Case study: Shortest path algorithms, Floyd's algorithm, dijkstra's algorithm , modular design review, modularity and parallel computing performance analysis; Case study: Convolution, tuple space and matrix multiplication.

MODULE-III: PARALLEL COMPUTING DEVELOPMENT TOOLS (08)

C++ review, C, C++ introduction, concurrency, locality, processor objects, global pointers thread placement, communication, remote operations. Synchronization, mutual exclusion, data transfer functions, asynchronous communication, determinism, mapping, modularity performance issues.

MODULE-IV: PARALLEL COMPUTING DEVELOPMENT TOOLS (09)

Fortran M, concurrency, communication, unstructured communication, asynchronous communication, determinism, argument passing, mapping, modularity, high performance Fortran, data parallelism, concurrency, data distribution, dummy arguments and modularity other HPF features, performance issues.

MODULE-V: ADD ON TOOLS FOR DEVELOPMENT (09)

Message passing libraries: The MPI programming model, MPI basics, C and Fortran language bindings with MPI functions, global operations, asynchronous communication, modularity, other MPI features, performance issues, performance tools, performance analysis, data collection, data transformation and visualization tools, paragraph, upshot—pablo, gauge, paraide, IBM's parallel environment, AIMS, custom tools.

V. TEXT BOOKS:

1. Ion Foster, "Designing and Building Parallel Programs", Addison Wesley, 1st Edition, 2003.

VI. REFERENCE BOOKS:

1. Arjen Markus, "Modern Fortran in Practice", Cambridge University Press, 1st Edition, 2012.
2. Charles H. Koelbe, "High Performance Fortran Handbook", MIT Press, 1st Edition, 1993.
3. Michael J. Quinn, "Parallel Programming in C with MPI and Open MPI", Tata McGraw-Hill Publishing Company Ltd, 1st Edition, 2003.

VII. WEB REFERENCES:

1. http://www.drdobbs.com/parallel/designing-parallel-algorithms-part-1/223100878.
2. http://searchcloudapplications.techtarget.com/tip/How-to-use-application-performance-modelingtechniques.
3. https://computing.llnl.gov/tutorials/parallel_comp/.

VIII. E-TEXT BOOKS:

1. https://www.free-ebooks.net/ebook/High-Performance-Computing.
2. https://archive.org/details/HighPerformanceComputing.

DATA SCIENCE

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC07	**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**		

I. COURSE OVERVIEW:

Data Science is a field of study that deals with the collection, analysis, and processing various data or information to extract solutions. It deals with the understanding of many structured and unstructured data with specialized knowledge to get the required insights. It is that part of science which also requires knowledge about business or commerce related fields.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamental knowledge on basics of data science and R programming.
II. The programs in R language for understanding and visualization of data using statistical functions and plots.
III. How to apply hypotheses and data into actionable predictions.
IV. A range of machine learning algorithms along with their strengths and weaknesses.
V. The document and transfer the results and effectively communicate the findings using visualization techniques.

III COURSE OUTCOMES:

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

CO 1	**Make use of** various data description functions in R programming for exhibiting various stages of the data science process.	Apply
CO 2	**Identify** interfacing packages for handling SQL and NoSQL databases for performing data analysis.	Analyze
CO 3	**Evaluate** data models using clustering and classification techniques.	Apply
CO 4	**Solve** various real-time problems on various hypothesis conditions by using artificial neural networks.	Apply
CO 5	**Illustrate** delivering results through documentation and visualization techniques	Understand

IV. SYLLABUS:

MODULE-I: INTRODUCTION (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.

MODULE-II: SQL, NOSQL AND DATA ANALYSIS (10)

SQL using R, excel and R, introduction to No SQL, connecting R to No SQL databases, R with XML, JSON; Correlation analysis; Covariance analysis, ANOVA, forecasting, heteroscedasticity, autocorrelation; Regression analysis: Regression modeling, multiple regression.

MODULE-III: DATA MODELS (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.

MODULE-IV: ARTIFICIAL NEURAL NETWORKS (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.

MODULE-V: DELIVERING RESULTS (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.

V 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.

VI. 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.

VII. 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.

VIII. 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.

DISTRIBUTED SYSTEMS

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC08	**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**		

I. COURSE OVERVIEW:

Distributed systems help students aggregate the resources of many networked computers to construct highly available and scalable services. The abstractions, design and implementation techniques that enable the building of fast, scalable, fault-tolerant distributed systems.

II COURSE OBJECTIVES:

The students will try to learn:

I. The fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment.
II. The insight into related research problems.
III. The principles, architectures, algorithms and programming models used in distributed systems.
IV. The state-of-the-art distributed systems, such as Google File System.
V. The importance of distribute systems and also know about how to implement sample distributed systems.

III. COURSE OUTCOMES:

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

CO 1	**Understand** the design principles in distributed systems and the architectures for distributed systems.	Understand
CO 2	**Apply** various distributed algorithms related to clock synchronization, concurrency control, deadlock detection, load balancing, voting in distributed databases.	Apply
CO 3	**Analyze** fault tolerance and recovery in distributed systems and algorithms.	Analyze
CO 4	**Analyze** the design and functioning of existing distributed systems and file systems.	Analyze
CO 5	**Develop** different distributed algorithms over current distributed platforms.	Apply

IV. SYLLABUS

MODULE-I: INTRODUCTION (10)

Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts.

DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE

Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

MODULE-II: DISTRIBUTED DATABASE DESIGN (10)

Alternative design strategies; Distributed design issues; Fragmentation; Data allocation. Semantics Data Control, View management; Data security; Semantic Integrity Control.

QUERY PROCESSING ISSUES

Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

MODULE-III: DISTRIBUTED QUERY OPTIMIZATION (08)

Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms. Transaction Management**:** The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models.

CONCURRENCY CONTROL

Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

MODULE-IV: RELIABILITY (09)

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

MODULE-V: PARALLEL DATABASE SYSTEMS (08)

Parallel architectures; parallel query processing and optimization; load balancing

V. TEXT BOOKS:

1. M.T. Ozsu and P. Valduriez, “Principles of Distributed Database Systems”, Prentice-Hall,1991.
2. D. Bell and J. Grimson, “Distributed Database Systems”, Addison-Wesley, 1992.

VI. REFERENCE BOOKS:

1. I. A. Dhotre, “Distributed Databases”, Technical publishers, 2020.

VII. 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.

VIII. 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.

MINING MASSIVE DATASETS

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC09	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course is based on text mining of massive data sets and their applications. Topics include map reduce and the new software stack, applications of similarity search, implementation of stream data, link analysis, handling large data set's, clustering, issues in online advertising, recommendation systems and mining social network graphs.

II. OBJECTIVES:

The course should enable the students to:

I	This course will cover practical algorithms for solving key problems in mining of massive datasets.
II	This course focuses on parallel algorithmic techniques that are used for large datasets.
III	This course will cover stream processing algorithms for data streams that arrive constantly, page ranking algorithms for web search, and online advertisement systems that are studied indetail.

III. COURSE OUTCOMES:

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

CO 1	Handle massive data using Map Reduce	Understand
CO 2	Develop and implement algorithms for massive data sets and methodologies in the context ofdata mining.	Apply
CO 3	Understand the algorithms for extracting models and information from large datasets	Understand
CO 4	Develop recommendation systems	Apply
CO 5	Gain experience in matching various algorithms for particular classes of problems.	Apply

IV. SYLLABUS:

MODULE-I: DATA MINING (09)

Introduction-Definition of Data Mining-Statistical Limits on Data Mining.

Map Reduce and the New Software Stack-Distributed File Systems, Map Reduce, Algorithms UsingMap Reduce.

MODULE-II: SIMILARITY SEARCH (8)

Finding Similar Items-Applications of Near-Neighbor Search, Shingling ofDocuments, Similarity-Preserving Summaries of Sets, Distance Measures.

Streaming Data: Mining Data Streams-The Stream Data Model, Sampling Data in a Stream, Filtering Streams.

MODULE-III: LINK ANALYSIS (10)

Page Rank, Efficient Computation of Page Rank, Link Spam.

Frequent Item sets-Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.

Clustering-The CURE Algorithm, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism.

MODULE-IV: ADVERTISING ON THE WEB (09)

Issues in On-Line Advertising, On-Line Algorithms, The Matching Problem,The Adwords Problem, Adwords Implementation.

Recommendation Systems-A Model for Recommendation Systems, Content-BasedRecommendations, Collaborative Filtering, Dimensionality Reduction, The NetFlix Challenge.

MODULE-V: MINING SOCIAL-NETWORK GRAPHS: (09)

Mining Social-Network Graphs - Social Networks as Graphs, Clustering of Social-Network Graphs, Partitioning of Graphs, Simrank, Counting Triangles.

V. TEXT BOOKS:

1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, 3rd Edition.

VI. REFERENCE BOOKS:

1. Jiawei Han & Micheline Kamber , Data Mining – Concepts and Techniques 3rd Edition Elsevier.
2. Margaret H Dunham, Data Mining Introductory and Advanced topics, PEA.
3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques,Morgan Kaufmann

WEB AND DATABASE SECURITY

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC10	**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**		

I. COURSE OVERVIEW:

Web security is critical to business and to protecting data, users and companies from risk. Web sites are increasingly using web applications to access database systems for information retrieval, transactions and publication.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Web architecture and applications.
II. The client side and service side programming.
III. How common mistakes can be bypassed and exploit the application.
IV. The common application vulnerabilities.

III. COURSEOUTCOMES:

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

CO 1	**Explain** basic cryptographic algorithms, message and web authentication in web security issues.	Understand
CO 2	**Identify** information system requirements for client and server.	Apply
CO 3	**Identify** security threats in web and database.	Apply
CO 4	**Utilize** security in Data Warehouses and OLAP Systems.	Apply
CO 5	**Make use of** web server security, physical security, host security for servers.	Apply

IV. COURSE SYLLABUS

MODULE-I: WEB SECURITY (09)

The Web Security Problem, Risk Analysis and Best Practices Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification.

MODULE-II: WEB PRIVACY (09)

The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications.

MODULE-III: DATABASE SECURITY (09)

Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems.

MODULE-IV: SECURITY RE-ENGINEERING FOR DATABASES (09)

Concepts and Techniques, Database Watermarking for Copyright Protection, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities.

MODULE-V: FUTURE TRENDS PRIVACY IN DATABASE PUBLISHING (09)

A Bayesian Perspective, Privacy-enhanced Location-based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment.

V. TEXT BOOKS:

1. Simson G. Arfinkel, Gene Spafford, Web Security, Privacy and Commerce, O' Reilly.
2. Michael Gertz, Sushil Jajodia, "Handbook on Database Security Applications and Trends".

VI. REFERENCE BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, Paperback, O' Reilly, 2020.
2. Michael Gertz, Sushil Jajodia, The Handbook of Database Security: Applications & Trends, Springer, 2nd Edition, 2010.

VII. WEB REFERENCES:

1. https://www.esecurityplanet.com/networks/database-security-best-practices/
2. https://www.ibm.com/cloud/learn/database-security

VIII. E-BOOKS:

1. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.377.8279&rep=rep1&type=pdf

ADVANCED DATA STRUCTURES LABORATORY

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC11	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 36**				**Total Classes:36**		

I. COURSE OVERVIEW:

It covers the design and analysis of fundamental data structures and engages learners to use advanced data structures as tools to algorithmically design efficient computer programs that will cope with the complexity of actual applications. This course is essential for image viewer software, music players, multi-player game using data structures.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The linear and nonlinear data structures and their implementations.
II. Algorithms based on their time and space complexity.
III. Appropriate data structure and algorithm design method for a specific application.
IV. The graph traversals algorithms to solve real-world challenges such as finding shortest paths on huge maps and assembling genomes from millions of pieces.

III. COURSE OUTCOMES:

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

CO1	**Design** and analyze a divide and conquer algorithm using data structures and ADT/libraries	Apply
CO2	**Use** stack operations for evaluating mathematical expressions.	Understand
CO3	**Demonstrate** collision resolution techniques with hashing technique	Apply
CO4	**Implement** set operations using union operations	Analyze
CO5	**Use** tree traversal algorithms for solving graph applications.	Evaluate

IV. SYLLABUS:

Week-1: DIVIDE AND CONQUER – 1

a. Implement Quick Sort on 1D array of Student structure (contains student name, student_roll_no, total_marks), with key as student_roll_no and count the number of swapperformed.
b. Implement Merge Sort on 1D array of Student structure (contains student_name, student_roll_no, total_marks), with key as student_roll_no and count the number of swapperformed

[Week-2: DIVIDE AND CONQUER – 2

a. Design and analyze a divide and conquer algorithm for following maximum sub-array sum problem: given an array of integer's find a sub-array [a contagious portion of the array] which gives the maximum sum.
b. Design a binary search on 1D array of Employee structure (contains employee_name, emp_no, emp_salary), with key as emp_no and count the number of comparison happened.

Week-3: IMPLEMENTATION OF STACK AND QUEUE

a. Implement 3-stacks of size 'm' in an array of size 'n' with all the basic operations such as Is Empty(i), Push(i), Pop(i), Is Full(i) where 'i' denotes the stack number (1,2,3), Stacks are not overlapping each other.
b. Design and implement Queue and its operations using Arrays.

Week-4: HASHING TECHNIQUES

Write a program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions use the following collision resolution techniques

a. Linear probing
b. Quadratic probing
c. Random probing
d. Double hashing/rehashing

Week-5: APPLICATIONS OF STACK

Write C programs for the following:

a. Uses Stack operations to convert infix expression into post fix expression.
b. Uses Stack operations for evaluating the post fix expression.

Week-6: BINARY SEARCH TREE

Write a program for Binary Search Tree to implement following operations:

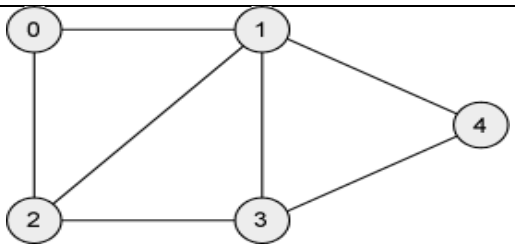
a. Insertion
b. Deletion
   i. Delete node with only child
   ii. Delete node with both children
c. Finding an element
d. Finding Min element
e. Finding Max element
f. Left child of the given node
g. Right child of the given node
h. Finding the number of nodes, leaves nodes, full nodes, ancestors, descendants.

Week-7: DISJOINT SET OPERATIONS

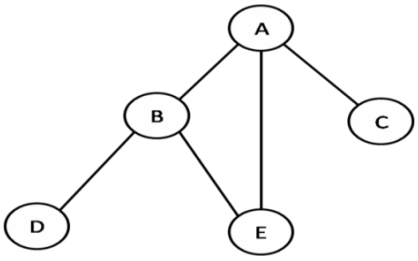
a. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with simple implementation of Unionoperation.
b. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with weighted-union heuristic approach.

Week-8: GRAPH TRAVERSAL TECHNIQUES

a. Print all the nodes reachable from a given starting node in a digraph using BFS method.

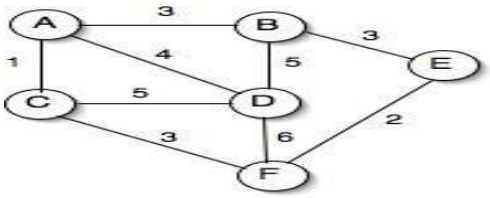


a. Check whether a given graph is connected or not using DFS method.



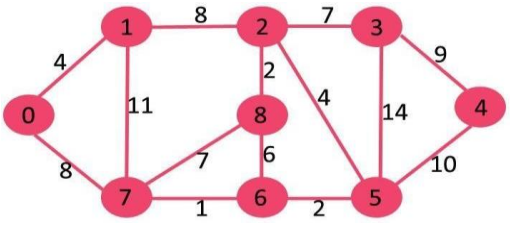
Week-9: SHORTEST PATHS ALGORITHM

From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.



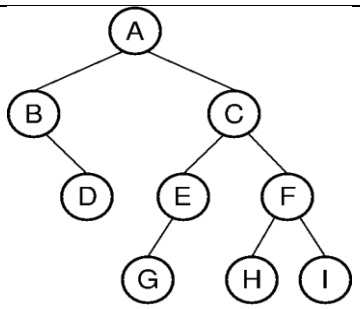
Week-10: MINIMUM COST SPANNING TREE

Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.



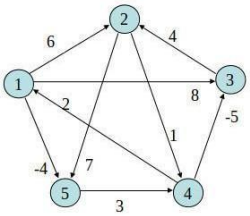
Week-11: TREE TRAVESRSALS

Perform various tree traversal algorithms for a given tree.



Week-12: ALL PAIRS SHORTEST PATHS

Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.



	1	2	3	4	5
1	0	6	8	∞	-4
2	∞	0	∞	1	7
3	∞	4	0	∞	∞
4	2	∞	-5	0	∞
5	∞	∞	∞	3	0

V. REFERENCE BOOKS:

1. Kernighan Brian W, Dennis M. Ritchie, "The C Programming Language", Prentice Hall of India, Re-Print, 2008.
2. Balagurusamy E, "Programming in ANSIC", Tata McGraw Hill, 6th Edition, 2008.
3. Gottfried Byron, "Schaum's Outline of Programming with C", Tata McGraw Hill, 1st Edition, 2010.
4. Lipschutz Seymour, "Data Structures Schaum's Outlines Series", Tata McGraw Hill, 3rdEdition, 2014.
5. HorowitzEllis, SatrajSahni,SusanAnderson,Freed,"FundamentalsofDataStructuresinC",W.H. Freeman Company, 2nd Edition, 2011.

VI. WEB REFERENCES:

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

DATA SCIENCE LABORATORY

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC12	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	30	70	100
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: 36**				**Total Classes: 36**		

I. COURSE OVERVIEW:

The Course is designed in various levels of data and use of R for statistical programming, analysis and visualization of processed data. It includes the basics of mathematics, probability and statistical methods and data communication. The techniques are used in Distribution and data analysis in non- parametric statistics such as image processing, e-commerce and banking.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concept of R objects.
II. Make use of different types of datasets for analysis using R.
III. Relations among variables using statistical analysis.
IV. The different data models for predictions using R

III. COURSE OUTCOMES:

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

CO1	**Make Use of** the container Data types for display the functional values.	Apply
CO2	**Demonstrate** the reading and writing operations from the web, and disk.	Apply
CO3	**Illustrate** the nature and relationships of data with effective visualizations for exploring the data.	Apply
CO4	**Analyze** the linear data models in data exploration.	Understand
CO5	**Develop** the classification and clustering models to label the data	Analyze

IV. SYLLABUS

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 data sets.
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.

V. REFERENCE BOOKS:

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

VI. 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

CYBER SECURITY

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC13	Core	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course focuses on effectively applying analytical and critical thinking to plan and execute security measures to shield an organization's computer systems, networks, and network devices from infiltration and cyber-attacks. Cyber Security course covers topics such as overview of cybercrimes, computer security, cryptography algorithms, internet hacking and cracking, web hacking, cybercrime investigation, digital forensics and certificates, securing databases, laws and acts. Provide career opportunities as Cyber Security Analyst, Cyber Security Practitioner, Cyber Defense Analyst and Information Security Engineer in leading IT and Governmental Organizations.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Preventing, monitoring, and responding to data breaches and cyber-attacks.
II. The core information of assurance principles.
III. The key components of cyber security network architecture.
IV. The cyber security architecture principles.

III. COURSE OUTCOMES:

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

CO 1	**Summarize** web security concepts to overcome cyber crimes	Apply
CO 2	**Make use of** cryptography techniques for protecting systems from unauthorized access and information protection	Understand
CO 3	**Demonstrate** cybercrime investigation tools for detecting and recovering the loss in the web domain.	Apply
CO 4	**Summarize** digital security procedures and policies to manage organizational security risks.	Apply
CO 5	**Outline** cyber laws and Acts to offer legal electric communication	Apply

IV. SYLLABUS

MODULE-I: INTRODUCTION (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 cybercrime, nature and scope of cybercrime, types of cybercrime: social engineering, categories of cybercrime, property cybercrime.

MODULE-II: REVIEW OF COMPUTER SECURITY AND CYBER CRIME ISSUES (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.

MODULE-III: WEB HACKING BASICS AND INVESTIGATION (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 cybercrime 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.

MODULE-IV: DIGITAL CERTIFICATES AND DIGITAL FORENSICS (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.

MODULE-V: SECURING DATABASES, LAWS AND ACTS (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.

V. 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", WroxPress, Illustrated Edition, 2001.

VI. REFERENCE BOOKS:

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

VII. WEB REFERENCES:

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

VIII. 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

SOFT COMPUTING

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC14	Core	3	-	-	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course covers the basics of intelligence techniques and methodologies of soft computing that differs from conventional artificial computations. This course is used for approximate calculations to provide imprecise but useable solutions to complex problems. This course includes intelligence systems, artificial neural network models, fuzzy logic and its inference system, and neuro-fuzzy system. The applications are used in pattern recognition, image processing, computer vision and information retrieval.

II. COURSE OBJECTIVES:

The students will try to learn:

1. The fuzzy logic and reasoning for handling uncertainty in problem solving
2. Introduce the ideas of neural networks, fuzzy logic.
3. The basics of intelligence techniques and methodologies of soft computing
4. The design and analysis of problem-solving using concepts of neural networks, neuro modeling, several neural networks paradigms.

III. COURSE OUTCOMES:

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

CO 1	**Recognize** the importance of knowledge representation and processing in intelligent system	Apply
CO 2	**Describe** the characteristics and constitutes of soft computing for decision making systems.	Understand
CO 3	**Demonstrate** the models of artificial neural systems for classification problems.	Apply
CO 4	**Apply** the learning rules and its working principle for computer vision and image processing applications.	Apply
CO 5	**Compare** the importance of auto and hetero associative memories for distinct cases of neural network systems.	Apply

IV. SYLLABUS:

MODULE-I: INTRODUCTION TO NEURAL NETWORKS (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.

MODULE-II: ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS (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: Kohonenself-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.

MODULE-III: FUZZY LOGIC (09)

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

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

MODULE-IV: FUZZY ARITHMETIC (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.

MODULE-V: GENETIC ALGORITHMS (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 imagefor 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.

V. TEXT BOOKS:

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

VI. REFERENCE BOOKS:

1. S.Rajasekaran, G.A.V.Pai,"NeuralNetworks,FuzzyLogicandGeneticAlgorithms",PHI, 1st Edition,2003.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 3rd Edition, 1997.
3. StamatiosV.Kartalopoulos"UnderstandingNeuralNetworksandFuzzyLogicBasicConceptsand Applications", IEEE Press, PHI, New Delhi, 2004.

VII. 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

VIII 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.

DATA PREPARATION AND ANALYSIS

II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC15	**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**		

I.COURSE OVERVIEW:

This course introduces the process of cleaning and transforming raw data before it is processed and analyzed. Students gain knowledge regarding the process involving reformatting the data, making adjustments to the data, and combining data sets to enrich the data.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The data for analysis and develop meaningful data visualizations.
II. How to perform exploratory analysis with the help of descriptive and perceptive statistics.
III. Illustrate data visualizations for understanding and presenting.

III.COURSE OUTCOMES:

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

CO 1	**Select** appropriate data preparation techniques to transform raw data into a standard format.	Understand
CO 2	**Apply** data cleaning methods on real-time data for usage of data in analytics	Understand
CO 3	**Make** use of statistical methods for performing exploratory analysis	Apply
CO 4	**Infer** complex data models with respect to time series and geographical data mining	Apply
CO 5	**Identify** the effective visualization techniques for data communication	Understand

IV. SYLLABUS:

MODULE - I DATA GATHERING AND PREPARATION (09)

Data formats, parsing and transformation, Scalability and real-time issues.

MODULE-II: DATA CLEANING (09)

Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation.

MODULE-III: EXPLORATORY ANALYSIS (09)

Descriptive and comparative statistics, Clustering and association, Hypothesis generation.

MODULE-IV: VISUALIZATION -1 (09)

Designing visualizations, Time series, Geo located data, Correlations and connections.

MODULE-V: VISUALIZATION -2 (09)

Hierarchies and networks, interactivity.

V. TEXT BOOKS:

1. GlennJ. Myatt, “Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining”, Wiley publishers, 2007.

VI REFERENCE BOOKS:

1. D. Pyle, Data Preparation for Data Mining. Morgan Kaufmann, 1999.
2. Ian H. Witten, Eibe Frank. Data Mining: Practical Machine Learning Tools and Techniques(Second Edition) Morgan Kaufmann, 2005.

VII 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

VIII. 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.

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING

II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSC16	**Elective**	3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course describes about processes and methodologies which are designed and implemented to protect print, electronic, or any other form of confidential, private and sensitive information or data from unauthorized access, use, misuse, disclosure, destruction, modification, or disruption.

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to identify or Fix software flaws and bugs in software.
II. The various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
III. The techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
IV. The methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

III. COURSEOUTCOMES:

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

CO 1	Understand methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.	Understand
CO 2	Study various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic.	Understand
CO 3	Know essential techniques for reducing and avoiding system and software security problems,	Apply
CO 4	Evaluate various enterprise application design and development tools and standard practices.	Evaluate
CO 5	Review techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment	Apply

IV. SYLLABUS

MODULE-I: SECURE SOFTWARE DESIGN (10)

Identify software vulnerabilities and perform software security analysis, Master security programming Practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

MODULE-II: ENTERPRISE APPLICATION DEVELOPMENT (09)

Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

MODULE-III: ENTERPRISE SYSTEMS ADMINISTRATIONS (08)

Design, implement and maintain a directory-based server infrastructure in a heterogeneous system Environment, monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

MODULE-IV: TROUBLESHOOTING (09)

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

MODULE-V: SOFTWARE EXCEPTIONS (08)

Handle insecure exceptions and command/SQL injection, defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

V. TEXT BOOKS:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley."

VI. REFERENCE BOOKS:

1. Theodor Richardson, Charles N Thies, "Secure Software Design", Jones & Bartlett.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, "Enterprise Software Security", Addison Wesley.
3. W. Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall.
4. C. P. Pfleeger, S. L. Pfleeger, "Security in Computing", Prentice Hall.
5. Gary McGraw, "Software Security: Building Security In", Addison-Wesley

VII. 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

VIII. 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
3. Mizutani,+Neuro,+Fuzzy+and+Soft+Computing,+PHI,+2004,Pearson+Education.

COMPUTER VISION

II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC17	**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**		

I. COURSE OVERVIEW:

This course provides insights into Image formation and filtering, including camera and optics -Light and color -Image filtering Image processing Feature detection and matching Image compression. The topics include Multiple views and stereo Recognition Segmentation Color Imaging, Introduction to spectral imaging and Introduction to machine learning Applications.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The theoretical and practical aspects of computing with images.
II. The foundation of image formation, measurement, and analysis.
III. The geometric relationships between 2D images and the 3D world.
IV. The principles of state-of-the-art deep neural networks.

III. COURSE OUTCOMES:

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

CO 1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision.	Understand
CO 2	Make use of basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,	Apply
CO 3	Experiment a design of a computer vision system for a specific problem	Apply
CO 4	Make use of clustering algorithms for finding the nearer objects	Apply
CO 5	Illustrate the classification algorithms for construction of a data model.	Apply

IV.SYLLABUS

MODULE –I: INTRODUCTION (08)

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis.

MODULE –II: EDGE DETECTION TECHNIQUES (09)

Edge detection, Edge detection performance, Hough transform, corner detection.

MODULE –III: SEGMENTATION (08)

Segmentation, Morphological filtering, Fourier transform.

MODULE –IV: FEATURE EXTRACTION (10)

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data pre-processing.

MODULE –V: ANALYSIS (10)

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians.
Classification: Discriminant Function, Supervised, Un-supervised, Semi supervised.
Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.

V TEXT BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.
2. Good fellow, Bengio, and Courville, "Deep Learning", MIT Press book, 2014.
3. Fisher et al, "Dictionary of Computer Vision and Image Processing", 2016.

VI. Reference Books:

1. Emanuele Trucco and AllessandroVerri "Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1998.
2. Olivier Faugeras, "Three-Dimensional Computer Vision", The MIT Press, 1993.

VII. WEB REFERENCES:

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

VIII. 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.

CLOUD COMPUTING

II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSC18	**Elective**	3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course enables students to learn a method of computing where a shared group of resources such as file storage, web servers, data processing services and applications are accessed via the internet. Students gain knowledge about how resources are housed in data centers around the world and are available to any person or device connected to the web.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concepts of cloud computing for developing the cloud applications.
II. The task scheduling algorithms and virtualization.
III. The security issues in cloud environments.
IV. The broad perceptive of cloud architecture and model.
V. The importance of various applications of cloud computing.

III. COURSEOUTCOMES:

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

CO 1	**Describe** the principles of Parallel and Distributed Computing and evolution of cloud computing from existing technology	Understand
CO 2	**Implement** different types of Virtualization technologies and Service Oriented Architecture systems	Understand
CO 3	**Elucidate** the concepts of NIST Cloud Computing architecture and its design challenges	Apply
CO 4	**Analyses** the issues in Resource provisioning and Security governance in clouds	Analyze
CO 5	**Choose** among various cloud technologies for implementing applications.	Apply

IV.SYLLABUS:

MODULE-I: INTRODUCTION (10)

Introduction: Definition, Characteristics, Benefits, challenges of cloud computing, cloud models: Service IaaS (infrastructure as service), PaaS (platform as a service), SaaS (software as a service), deployment models-public, private, hybrid, community; Types of cloud computing: Grid computing utility computing, cluster; computing Cloud services: Amazon, Google, Azure, online services, open-source private clouds, SLA; Applications of cloud computing: Healthcare, energy systems, transportation, manufacturing, education, government, mobile communication, application development.

MODULE-II: CLOUD ARCHITECTURE, PROGRAMMING MODEL (09)

Edge detection, Edge detection performance, Hough transform, corner d Cloud Architecture, programming model: NIST reference architecture, architectural styles of cloud applications, single, multi, hybrid cloud site, redundant, non-redundant, 3 tier, multitier architectures; Programming model: Compute and data intensifications.

MODULE-III: CLOUD RESOURCE VIRTUALIZATION (08)

Cloud resource virtualization: Basics of virtualization, types of virtualization techniques, merits and demerits of virtualization, Full vs Para - virtualization, virtual machine monitor/hypervisor. Virtual machine basics, taxonomy of virtual machines, process vs system virtual machines

MODULE-IV: CLOUD RESOURCE MANAGEMENT AND SCHEDULING (09)

Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, resource bundling, combinatorial, fair queuing, start time fair queuing, borrowed virtual time, cloud scheduling subject to deadlines, scheduling map reduce applications subject to deadlines, resource management and application scaling.

MODULE-V: CLOUD SECURITY (08)

Cloud Security: Risks, privacy and privacy impacts assessments; Multi-tenancy issues, security in VM, OS, virtualization system security issues and vulnerabilities; Virtualization system-specific attacks: Technologies for virtualization-based security enhancement, legal.

V. TEXT BOOKS:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett, 2013.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, "Enterprise Software Security, Addison Wesley", 1st Edition, 2014.

VI. REFERENCE BOOKS:

1. W. Stallings, Cryptography and network security: Principles and practice, Prentice Hall, 4th Edition, 2005.
2. C. P. Pfleeger, S. L. Pfleeger, "Security in Computing", Prentice Hall, 5th Edition, 2015.
3. Gary McGraw, "Software Security: Building Security In", Addison-Wesley,1st Edition, 2006.

VII. WEB REFERENCES:

1. https://www.oracle.com/in/cloud/application-development
2. http://computingcareers.acm.org/?page_id=12 3. http://en.wikibooks.org/wiki/cloud application

VIII. 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.

INTERNET OF THINGS AND APPLICATIONS

II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC19	**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**		

I. COURSE OVERVIEW:

Internet of things (IoT) is a network of things that are embedded with software and sensors to process data. This course includes physical and logical design of IoT systems, M2M systems, SDN, IoT Architecture components such as physical devices and endpoints, physical servers and cloud offerings. This is used in various applications such as Smart Refrigerator, Smart Homes and Smart environments.

II. COURSE OBJECTIVES:

The students will try to learn:

1. The architecture of Internet of Things and connected world.
2. The different hardware and sensing technologies to build IoT applications.
3. The real time IoT applications to make smart world.
4. The available cloud services and communication API's for developing smart cities.

III. COURSEOUTCOMES:

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

CO 1	**Summarize** the characteristics and appropriate levels of IoT for reusing of deployed IoT resources across application domains.	Remember
CO 2	**Identify** the necessity of communication models, protocols and API's for accessing data from sensors and actuators to overcome issues like failure of any connected devices.	Understand
CO 3	**Compare** Machine to Machine withIoT and identifying the role of SDN,NFV, NETCONFG-YANG for data exchange between devices and management on network.	Understand
CO 4	**Illustrate** architectural reference models and state of the art methodologies in IoT application domains for managing access control of IoT devices.	Apply
CO 5	**Analyze** different cloud storage models and protocols that are scalable	Understand

IV. COURSE SYLLABUS

MODULE – I: INTRODUCTION (08)

Definition and characteristics of IoT, physical design of IoT, logical design of IoT, IoT enabling technologies, IoT levels and deployment, domain specific IoTs.

MODULE-II: IOT AND M2M (10)

Introduction, M2M, difference between IoT and M2M, software defined networking (SDN) and network Function virtualization (NFV) for IoT, basics of IoT system management with NETCONF-YANG.

MODULE-III: IOT ARCHITECTURE AND TOOLS (08)

IoT Architecture: State of the art introduction, state of the art; Architecture reference model: Introduction, reference model and architecture, IoT reference model. IoT Reference model-IoT ecosystem and Business models- Introduction to Protocols of IoT: D2D, D2S, S2S, Introduction to simulation tools.

MODULE-IV: MODELLING TECHNIQUES (09)

Introduction to Raspberry Pi interfaces (Serial, SPI, I2C), programming Raspberry PI with Python, other IoT devices.

MODULE-V: IOT PHYSICAL SERVERS AND CLOUD OFFERINGS (08)

Introduction to cloud storage models and communication APIs; WAMP: AutoBahn for IoT, Xively cloud For IoT; Case studies illustrating IoT design: Home automation, smart cities, smart environment.

V. TEXT BOOKS:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-on-Approach", VPT, 1st Edition, 2014.
2. Matt Richard son,ShawnWallace, "Getting Started with RaspberryPi", O_Reilly (SPD), 3rd Edition, 2014.

VI. REFERENCE BOOKS:

1. Derek Molloy, "Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux" Wiley publishers, 1st Edition, 2020.

VII. Web References:

1. https://www.upf.edu/pra/en/3376/22580.
2. https://www.coursera.org/learn/iot.

VIII. 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.

GPU COMPUTING

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC20	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The GPU accelerates applications running on the CPU by offloading some of the compute-intensive and time-consuming portions of the code. This course includes memory hierarchy, consistency, and debugging gpu programs.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concepts of parallel programming in problem solving.
II. The Debugging and profiling parallel programs.
III. The GPU synchronizations.

III. COURSEOUTCOMES:

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

CO 1	Define terminology commonly used in parallel computing, such as efficiency and speedup.	Remember
CO 2	Explain common GPU architectures and programming models	Understand
CO 3	Identify efficient algorithms for common application kernels, such as matrix multiplication.	Apply
CO 4	Develop an efficient parallel algorithm to solve it.	Apply
CO 5	Identify an efficient and correct code to solve it, analyze its performance, and give convincing written and oral presentations explaining the achievements.	Apply

IV. SYLLABUS:

MODULE-I: INTRODUCTION (13)

History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA Open CL / Open ACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wave fronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D / 3D thread mapping, Device properties, Simple Programs.

MODULE-I: MEMORY (08)

Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.

MODULE-III: SYNCHRONIZATION (08)

Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Work lists, Linked-lists. Synchronization across CPU and GPU

Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

MODULE-IV: SUPPORT AND STREAMS (09)

Debugging GPU Programs. Profiling, Profile tools, Performance aspects

Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.

MODULE-V: CASE STUDIES (05)

Image Processing, Graph algorithms, Simulations, Deep Learning.

V. TEXT BOOKS:

1. David Kirk, Wen-meiHwu, Morgan Kaufman, "Programming Massively Parallel Processors: A Hands- on Approach", 2010 (ISBN:978-0123814722).
2. Shane Cook, Morgan Kaufman "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", 2012 (ISBN:978-0124159334).

VI. REFERENCE BOOKS:

1. Dr Brian Tuomanen, "Hands-On GPU Programming with Python and CUDA", Packt, 2014.

VII. 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

VIII. 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
3. Mizutani,+Neuro,+Fuzzy+and+Soft+Computing,+PHI,+2004,Pearson+Education.

DIGITAL FORENSICS

II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC21	**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**		

I. COURSE OVERVIEW:

This course provides a broad overview of computer forensics as an occupation by exploring methodologies used surrounding digital forensics. In addition, the student acquires open-source forensic tools to use throughout this path. This course includes digital forensics science, computer crime, cybercrime scene analysis, evidence management, presentation and legal aspects of digital forensics.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The in-depth study of the rapidly changing and fascinating field of computer forensics.
II. Both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
III. Digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
IV. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics

III. COURSE OUTCOMES:

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

CO 1	**Organize** digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting.	Create
CO 2	**Understand** the Computer forensics and digital detective and various processes, policies and procedures.	Apply
CO 3	**Identify** E-discovery, guidelines and standards, E-evidence, tools and environment.	Evaluate
CO 4	**Experiment** Email and web forensics and network forensics**.**	Apply
CO 5	**Relate** work collaboratively with clients, management, and/or law enforcement to advance digital investigations or protect the security of digital resources.	Knowledge

IV. SYLLABUS

MODULE – I: DIGITAL FORENSICS SCIENCE AND COMPUTER CRIME (09)

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.

MODULE-II: CYBER CRIME SCENE ANALYSIS (09)

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding

what court documents would be required for a criminal investigation.

MODULE-III: EVIDENCE MANAGEMENT & PRESENTATION (09)

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

MODULE-IV: COMPUTER FORENSICS AND NETWORK FORENSICS (09)

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case,
Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

MODULE-V: MOBILE FORENSICS AND LEGAL ASPECTS OF DIGITAL FORENSICS (09)

Mobile Forensics: mobile forensics techniques, mobile forensics tools.
Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008, Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

V. TEXT BOOKS:

1. John Sammons, “The Basics of Digital Forensics”, Elsevier, 2014.
2. John Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Laxmi Publications 2005.

VI. REFERENCE BOOKS

1. Brian Carrier , "File System Forensic Analysis" , Addison Wesley, 2005
2. Dan Farmer &WietseVenema ,"Forensic Discovery", Addison Wesley, 2005

VII. WEB REFERENCES:

1. https://www.researchgate.net/publication/300474145_Digital_Forensics
2. https://ec.europa.eu/programmes/erasmus-plus/project-result-content/2a54509d-b6bb-43d8-8250-eae26782c392/FORC%20Book%201.pdf

VIII. E-Text Books:

1. https://booksite.elsevier.com/samplechapters/9781597496612/Front_Matter.pdf

BIG DATA ANALYTICS

II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSC22	**Elective**	3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course provides a clear understanding on concepts of sources of big data, characteristics, storing and processing components, and analytics applications. This course emphasizes on potential impact of big data challenges, open research issues, and various tools associated with it This course includes the introduction and processing big data with an overview of Hadoop technology and its components such as pig, hive, etc.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Fundamentals of big data for business intelligence.
II. The various business case studies for big data analytics and no sql big data management.
III. The Performance of map-reduce analytics using Hadoop and related tool

III. COURSE OUTCOMES:

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

CO 1	**Compare** big data analysis and analytics in optimizing the business decisions.	Understand
CO 2	**Understand in** detailed about architecture, define objects, load data, query data and performance tune in document-oriented No SQL databases.	Understand
CO 3	**Classify** the key issues and applications in intelligent business and scientific computing.	Apply
CO 4	**Understand** the big data technologies used to process and querying the big data in Hadoop, MapReduce, Pig and Hive.	Understand
CO 5	**Make use of** appropriate components for processing, scheduling and knowledge extraction from large volumes in distributed Hadoop Ecosystem.	Apply

IV. SYLLABUS

MODULE – I: **INTRODUCTION TO BIG DATA (09)**

What is big data, History of Data Management; Structuring Big Data; Elements of Big Data; Big Data Analytics; Distributed and Parallel Computing for Big Data; Big Data Analytics: What is Big Data Analytics, What Big Data Analytics Isn't, Why this sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools.

MODULE-II: ANALYTICS (09)

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.

MODULE-III: MAP REDUCE AND HBASE (09)

The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; 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;

Introducing HBase, Architecture, Storing Big Data with HBase, interacting with the Hadoop Ecosystem; HBase in Operations-Programming with HBase; Installation, Combining HBase and HDFS.

MODULE-IV: BIG DATA TECHNOLOGY LANDSCAPE (09)

NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors; HDFC (Hadoop Distributed File System), HDFC Daemons, read, write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN.

MODULE-V: SOCIAL MEDIA ANALYTICS AND TEXT MINING (09)

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.

V. TEXT BOOKS:

1. Seema Acharya, SubhasininChellappan, “Big Data and Analytics”, Wiley Publications 2019.
2. DT Editorial Services,”Big Data Black Book”, DreamTech Press, 2015.

VI. REFERENCE BOOKS:

1. Albright, Winston, “Business Analytics” Cengage Learning, 2014.

VII. 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

VIII. E-TEXT BOOKS:

1. http://oms.bdu.ac.in/ec/admin/contents/175_P16CSE5A-P16ITE3A_2020052206242390.pdf
2. https://ebooks.wileyindia.com/product/big-data-analytics

SOFT COMPUTING LABORATORY

II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC23	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	30	70	100
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: 36**				**Total Classes: 36**		

I. COURSE OVERVIEW:

This course focuses on tools such as Fuzzy Computing, Neuro-Computing, Evolutionary Computing, Probabilistic Computing, and Immunological Computing. The main objective of the proposed virtual lab is to introduce students about the latest Computational Intelligence Tools. The training of these tools will be useful to develop rigorous applications in the engineering domain.

II. COURSE OBJECTIVES:

The students will try to learn**:**

1. The fundamental Fuzzy concepts.
2. The Neural networks with back propagation and without propagation.
3. The operators of genetic algorithms.
4. The various crisp partitions.

III. COURSE OUTCOMES:

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

CO 1	**Develop** an ANN model with or without backpropagation	Apply
CO 2	**Show** fuzzy relations on fuzzy relations to handle uncertainty and solve engineering problems	Understand
CO 3	**Apply** genetic algorithms to combinatorial optimization problems	Apply
CO 4	**Use** the ANOVA model for analyzing the covariance of data	Apply
CO 5	**Solve** real problems using a soft computing approach	Apply

IV. SYLLABUS

Week-1: PERCEPTRON

Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights

Week-2: ARTIFICIAL NEAURAL NETWORKS

A. Write a program to implement artificial neural network without back propagation.
B. Write a program to implement artificial neural network with back propagation.

Week-3: FUZZY SETS

Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.

Week-4: GENETIC ALGORITHMS
Implement travelling sales person problem (TSP) using genetic algorithms.

Week-5: COVARIANCE
Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

Week-6: DATA FITTING BY REGRESSION
Implement linear regression and multi-regression for a set of data points.

Week-7: CRISP MODEL
Implement crisp partitions for real-life iris dataset.

Week-8: PERCEPTRON RULE
Write a program to implement Hebb's rule

Week-9: LOGIC GATES
Write a program to implement logic gates.

Week-10: ARTIFICIAL NEAURAL NETWORKS
Write a program to implement artificial neural network with back propagation.

Week-11: CLASSIFICATION
Implement SVM classification by Fuzzy concepts

Week-12: PERCEPTRON RULE
Write a program to implement Delta rule.

V. REFERENCE BOOKS:
1. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Mc Graw Hill, 3rd Edition,1997.

VI. Web References:
https://www.books.google.co.in/books?id=bVbj9nhvHd4C

CYBER SECURITY LABORATORY

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC24	Core	0	0	4	2	30	70	100
Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36				Total Classes: 36		

I. COURSE OVERVIEW:

This course covers advanced techniques for writing exploits and patching vulnerabilities, taught through an intense, hands-on security laboratory. It deals about the cyber attackers, their tactics, social engineering, and high-profile case studies. This course covers a variety of topics including reverse engineering, exploitation, binary analysis, and web.

II. COURSE OBJECTIVES:

The students will try to learn:

1 How to implement the cryptographic algorithms.
2 How to identify, analyze, and remediate computer security breaches.
3 The key cyber security vendors in the marketplace.
4 The importance of digital signatures algorithms

III. COURSE OUTCOMES:

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

CO 1	**Implement** encryption and decryption techniques for providing security solutions.	Apply
CO 2	**Analyze** the impact of public key cryptosystems for secure exchange of information.	Understand
CO 3	**Experiment** a signature scheme using Digital signature standard.	Apply
CO 4	**Use** of hashing and authentication for implementing data integrity.	Apply
CO 5	**Use** firewall mechanism for restricting user activities over network.	Apply

IV. SYLLABUS

Week-1: CIPHER ALGORITHM

Implementation of symmetric cipher algorithm (AES and RC4)

Week-2: RANDOM NUMBER GENERATION

Random number generation using a subset of digits and alphabets.

Week-3: RSA ALGORITHM

Implementation of RSA based signature system

Week-4: RANDOM NUMBER GENERATION

Implementation of Subset sum of numbers

Week-5: WEB TRANSACTIONS

Implementation of a trusted secure web transaction.

Week-6: HASH ALGORITHM

Authenticating the given signature using MD5 hash algorithm.

Week-7: DIFFIE-HELLMAN ALGORITHM
Implementation of Diffie-Hellman algorithm

Week-8: CRYPTOSYSTEM
Implementation EIGAMAL cryptosystem.

Week-9: PUBLIC KEY SYSTEM
Implementation of Goldwasser-Micali probabilistic public key system

Week-10: CRYPTOSYSTEM
Implementation of Rabin Cryptosystem.

Week-11: KERBEROS
Implementation of Kerberos cryptosystem

Week-12: FIREWALL IMPLEMENTATION
Firewall implementation and testing.

V. REFERENCE BOOKS

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Principles of Information Security, Whitman, Thomson.

VI. WEB REFERENCES:

1. https://www.iiitm.ac.in/index.php/en/information-security-lab
2. https://omscs.gatech.edu/cs-6265-information-security-lab
3. https://www.iitr.ac.in/departments/CSE/pages/Facilities+Information_Security_Lab.html
4. https://isec.unige.ch/

MINI PROJECT WITH SEMINAR

II Semester: CS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSC25	**Core**	0	0	4	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes:45**		

I. COURSE OBJECTIVES:

The student will try to learn:

I. How to identify various engineering problems and reviewing available literature.
II. The different techniques used to analyze the complex structural systems.
III. Work on the solutions given and present solution by using his/her technique applying engineering principles.

II. COURSE OUTCOMES:

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

CO 1	**Identify** and Implement an investigative or developmental project with given general objectives and guidelines	Apply
CO 2	**Develop** an In-depth skill to use some laboratory, modern tools and techniques.	Understand
CO 3	**Analyze** data to produce useful information and draw conclusions.	Apply
CO 4	**Communicate** results, concepts, analyses and ideas in written and oral form.	Apply
CO 5	**Conduct** an extended independent investigation that results in the production of a research thesis.	Apply

Guidelines to be followed

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the Departmental committee.

RESEARCH METHODOLOGY AND IPR

III Semester: CSE, ES, CAD/CAM, AE, ST, PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC11	Core	2	-	-	2	30	70	100
Contact Classes: 30	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:30		

I. COURSE OVERVIEW:

This course imparts research methodology and philosophy of intellectual property rights, including basic concepts employed in quantitative and qualitative research methods, Patents, Copyrights, and Trademarks. It provides the research framework, research methodology research design, and formulation hypothesis, sampling techniques, data analysis and report writing. It implies on research skills and intellectual property rights to encourage new creations, including technology, artwork, and inventions, that might increase economic growth.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Knowledge on formulate the research problem, characteristics of a good research and interpretation of collected data.

II. The importance of research ethics while preparing literature survey and writing thesis to achieve plagiarism free report.

III. The intellectual property rights such as patent, trademark, geographical indications and copyright for the protection of their invention done.

III. COURSE OUTCOMES:

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

CO1	**Interpret** the technique of determining a research problem for a crucial part of the research study.	**Remember**
CO2	**Examine** the way of methods for avoiding plagiarism in research.	**Apply**
CO3	**Apply** the feasibility and practicality of research methodology for a proposed project.	**Apply**
CO4	**Make use of** the legal procedure and document for claiming patent of invention.	**Understand**
CO5	**Identify** different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP.	**Understand**
CO6	**Defend** the intellectual property rights throughout the world with the involvement of world intellectual property organization	**Apply**

IV. SYLLABUS:

MODULE – I: INTRODUCTION (9)

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

MODULE – II: RESEARCH ETHICS 9)
Effective literature studies approaches, analysis Plagiarism, Research ethics.

MODULE – III: RESEARCHPROPOSAL
Effective technical writing, how to write report, Paper Developing a Research Proposal.

Format of research proposal, presentation and assessment by iare view committee

MODULE – IV: PATENTING (9)
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

MODULE – V: PATENT RIGHTS (9)
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

V. TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering student".
2. Wayne Goddard and Stuart Melville ,"Research Methodology: An Introduction"
3. RanjitKumar, "Research Methodology: A Step by Step Guide for beginners". 2nd Edition, 2007.

VI. REFERENCE BOOKS:

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962.

VII. WEB REFERENCES:

1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
2. T.Ramappa,"Intellectual Property Rights Under WTO",S.Chand, 2008.

VIII. E-TEXT BOOKS:

1. http://nptel.ac.in/courses/107108011/

MOBILE APPLICATIONS AND SERVICES

III Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC26	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course is concerned with the development of applications on mobile and wireless computing platforms. It covers the basics of mobile computing, Android development security and hacking. It uses tools and frameworks required to develop applications for current and emerging mobile computing devices.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The mobile platforms and their ecosystems like Android, OS, and Phone Gap.
II. The techniques for deploying and testing mobile application.
III. The different platforms of mobile development about additional issue like security, hacking etc.
IV. The methodology to develop mobile applications using a chosen application development framework.

III. COURSE OUTCOMES:

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

CO 1	Create, test and debug Android application by setting up Android development environment	Apply
CO 2	Implement adaptive, responsive user interfaces that work across a wide range of devices.	Apply
CO 3	Infer long running tasks and background work in Android applications	Understand
CO 4	Prepare mobile application for multimedia and learn about additional issue like security, hacking	Apply
CO 5	Calculate performance of android applications and understand the role of permissions and security	Apply

IV. SYLLABUS:

MODULE-I: INTRODUCTION TO MOBILE COMPUTING (09)

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User.

MODULE-II: MOBILE COMPUTING -MORE ON UIS (09)

More on UIs: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal UIs, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

MODULE-III: NETWORK AND THE WEB:STATE MACHINE (09)

Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps,

Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics.

MODULE-IV: PUTTING IT ALL TOGETHER AND MULTIMEDIA (09)

Putting It All Together : Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android.
Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia.

MODULE-V: PLATFORMS AND ADDITIONAL ISSUES ,SECURITY AND HACKING (09)

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android.

V. TEXT BOOKS:

1. Wei-Meng Lee, "Beginning Android™ 4 Application Development", 2012 by John Wiley & Sons.

VI. REFERENCE BOOKS:

1. Sandeep Singhal, "The Wireless Application Protocol: Writing Applications for the Mobile Internet", Addison Wesley Longman, 2000.

VII. 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

VIII. 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.

ADVANCED ALGORITHMS

III Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC27	**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**		

I. COURSE OVERVIEW:

This course covers some of the general-purpose data structures and algorithms, and software development. It includes managing complexity, analysis, lists, stacks, queues, trees, graphs, balanced search trees and hashing mechanisms. This course is to how to select and design data structures and algorithms that are appropriate for problems that they might encounter in real life.

II COURSE OBJECTIVES:

The students will try to learn:

I. The advanced methods of designing and analyzing algorithms.
II. The methodology to choose appropriate algorithms and use it for a specific problem.
III. The different classes of problems concerning their computation difficulties.
IV. The recent developments in the area of algorithmic design.

III. COURSE OUTCOMES:

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

CO 1	Make use of recursive algorithm design technique in appropriate contexts	Apply
CO 2	Design and implement linked lists, stacks and queues in Python	Understand
CO 3	Calculate linear programming using Approximation and Randomized algorithm	Apply
CO 4	Experiment flow-networks and matrix computation using strassen's algorithm	Apply
CO 5	Calculate the algorithm complexity using time/space analysis	Apply

IV. SYLLABUS:

MODULE-I: GRAPH ALGORITHMS (09)

Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

MODULE-II: MATROIDS ANDGRAPH MATCHING (09)

Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Algorithm to compute maximum matching. Characterization of maximum matching by augmentingpaths, Edmond's Blossom algorithm to compute augmenting path.

MODULE-III: FLOW-NETWORKS AND MATRIX COMPUTATIONS (09)

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximumflow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

MODULE-IV: SHORTEST PATH IN GRAPHS (09)

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm.

MODULE-V: LINEAR PROGRAMMING (09)

Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest: Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

V. TEXT BOOKS:

1. Aho, Hopcroft, “The Design and Analysis of Computer Algorithms”, Ullman.Addison-Wesley Series in Computer Science and Information Processing, 1974.

VI. REFERENCE BOOKS:

1. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms",MIT Press, 1989.

VII WEB REFERENCES:

1. https://www.coursera.org/learn/advanced-algorithms-and-complexity
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-854j-advanced-algorithms-fall-2005/

VIII. E-TEXTBOOKS

1. https://people.seas.harvard.edu/~cs224/fall14/index.html

OPTIMIZATION TECHNIQUES

III Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSC28	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course is used to maintain a balance between theory, numerical computation, and problem setup for solution by optimization software. The course covers the basic methods of optimization techniques, design algorithms, establish their correctness, study their efficiency and memory needs. Optimization techniques are used in real life problems and their mathematical formulation as standard programming problems.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The linear programming problem with approximate solutions.
II. How to optimize these mathematical problems using nature based algorithms.
III. The dynamic programming and quadratic approximation to electrical and electronic problems and applications.
IV. The appropriate technique to solve Game problem.

III. COURSE OUTCOMES:

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

CO 1	**Make** use of recursive algorithm design technique in appropriate contexts.	Create
CO 2	**Calculate** and implement linked lists, stacks and queues in Python	Apply
CO 3	**Choose** linear programming using Approximation and Randomized algorithm	Evaluate
CO 4	**Design** flow-networks and matrix computation using Strassen's algorithm	Apply
CO 5	**Describe** the variable metric methods for constrained optimization**.**	Knowledge

IV. SYLLABUS

MODULE-I: ENGINEERING APPLICATION OF OPTIMIZATION (09)

Engineering application of optimization, formulation of design problems as mathematical programming problems.

MODULE-II: GENERAL STRUCTURE OF OPTIMIZATION (09)

General Structure of Optimization Algorithms, Constraints, The Feasible Region.

MODULE-III: BRANCHES OF MATHEMATICAL PROGRAMMING (09)

Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming

MODULE-IV: OPTIMIZATION ALGORITHMS (09)

Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

MODULE-V: REAL LIFE PROBLEMS (09)

Real life Problems and their mathematical formulation as standard programming problems.

V. TEXT BOOKS:

1. Laurence A. Wolsey, “Integer Programming”. Wiley. ISBN978-0-471-28366-9, 1998.
2. AndreasAntoniou, “Practical Optimization Algorithms and Engineering Applications”, Springer, 2007.
3. Edwin K., P. Chong & Stanislaw h.Zak, “An Introduction to Optimization”, Wiley-Inter science, 1996.

VI. REFERENCE BOOKS:

1. Dimitris Bertsimas; Robert Weismantel, “Optimization Over Integers”. Dynamic Ideas. ISBN 978-0-9759146-2-5, 2005.
2. John K. Karlof, “Integer programming: theory and practice”. CRC Press. ISBN 978-0-8493- 1914-3, 2006.
3. H. Paul Williams,” Logic and Integer Programming”. Springer. ISBN978-0-387-92279-9, 2009.

VII. WEB REFERENCES:

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

VIII. 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.

MOBILE APPLICATION DEVELOPMENT

III Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC29	**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**		

I. COURSE OVERVIEW:

This course focuses on the java API'S and tools necessary for developing mobile applications. It covers the necessary language features for mobile programming and focuses particularly on the Mobile Information Device Profile used in mobile phone application development. This course is used to build a mobile application interface using J2ME, connecting via HTTP to the web tier interface of a Java application.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamentals of Android operating systems.
II. The skills of using Android software development tools.
III. How to deploy mobile applications with reasonable complexity on mobile platform.
IV. The programs running on mobile devices.

III. COURSE OUTCOMES:

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

CO 1	**Select** suitable software tools and APIs for the development of a particular mobile application	Remember
CO 2	**Use** Intents to dial a number to send SMS Broadcast Receivers	Apply
CO-3	**Demonstrate** creating a file and reading data from files using Persistent Storage	
CO 4	**Use** a content provider for inserting, deleting, retrieving and updating data using SQLite	Apply
CO 5	**Develop** mobile applications with good design and interactive features for mobile devices.	Apply

IV. COURSE SYLLABUS

MODULE-I: INTRODUCTION TO ANDROID OPERATING SYSTEM (09)

Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes.

MODULE-II: ANDROID USER INTERFACE (09)

Measurements – Device and pixel density independent measuring UNIT – s Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non editableTextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment

states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

MODULE-III: INTENTS AND BROADCASTS (09)

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toasts.

MODULE-IV: STORAGE (09)

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference.

MODULE-V: SQ Lite (09)

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update).

V. TEXT BOOKS:

1. Reto Meier, "Professional Android 4 Application Network Development", Wiley India, (Wrox), 2012.
2. James C Sheusi, "Android Application Development for Java Programmers", Cengage Learning, 2013.

VI REFERENCE BOOKS:

1. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox), 2013.

VII. Web References:

1. https://www.udemy.com/course/learn-android-application-development-y/
2. https://www.tutorialspoint.com/android/index.htm
3. https://www.geeksforgeeks.org/android-app-development-fundamentals-for-beginners/

VIII. E-BOOKS:

1. https://web.stanford.edu/class/cs231m/lectures/lecture-2-android-dev.pdf

ELEMENTS OF AEROSPACE ENGINEERING

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours /Week**			**Credits**	**Maximum Marks**		
BAEC30	**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**		

I. COURSE OVERVIEW:

Aeronautical engineering is the specialized branch of engineering and study of science that deals with design, construction, maintenance of various aircrafts and their components. Candidates who have an inclination towards airplanes and their mechanisms can opt to study aeronautical engineering.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Historical evaluation of Airplanes
II. The different component systems and functions
III. The various types of power plants used in aircrafts

III. COURSE OUTCOMES:

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

CO 1	**Learn** the history of aircraft & developments over the years	Understand
CO 2	**Understand** ability to identify the types & classifications of components and control systems	Understand
CO 3	**Understand** the basic concepts of flight & Physical properties of Atmosphere	Understand
CO 4	**Understand** the different Newtonian law and its application in aerospace domain	Understand
CO 5	**Explain** the Different types of Engines and principles of Rocket	Understand
CO 6	**Understand** ability to differentiate the types of fuselage and constructions	Understand

IV. COURSE SYLLABUS:

MODULE-I: HISTORY OF FLIGHT (07)

Balloon flight-ornithopers-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

MODULE-II: AIRCRAFT CONFIGURATIONS AND ITS CONTROLS (08)

Different types of flight vehicles, classifications-Components of an airplane and their functions-Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation.

MODULE-III: BASICS OF AERODYNAMICS (06)

Physical Properties and structures of the Atmosphere, Temperature, pressure and altitude relationships, Newton's Law of Motions applied to Aeronautics-Evolution of lift, drag and moment. Aerofoils, Mach number, Maneuvers.

MODULE-IV: BASICS OF PROPULSION (06)

Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust production-Comparative merits, Principle of operation of rocket, types of rocket and typical applications, Exploration into space.

MODULE-V: BASICS OF AIRCRAFT STRUCTURES (06)

General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials. Stresses and strains-Hooke's law- stress-strain diagrams-elastic constants-Factor of Safety.

V. TEXT BOOKS:

1. Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th Edition, 2015
2. Stephen.A. Brandt, Introduction to aeronautics: A design perspective, AIAA Education Series, 2nd Edition 2004.

VI. REFERENCE BOOKS:

Kermode, A.C. "Flight without Formulae", Pearson Education, 11th Edition, 2011.

VII. WEBREFERENCES:

1. http://memberfiles.freewebs.com/94/47/55224794/documents/airport%20planning%20and%20management.pdf
2. https://books.google.co.in/books?id=RYR6cu4YSBcC&dq=Planning%20and%20Design%20of%20Airports&source=gbs_similarbooks

VIII. E-TEXTBOOKS:

https://nptel.ac.in/courses/101/101/101101079/

DATA ANALYTICS

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC30	**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**		

I. COURSE OVERVIEW:

This course covers the fundamentals of data analysis, such as data gathering or data mining .this course covers concepts of data analysis, regression analysis, organization structures, forecasting techniques and decision analysis. The *data analytics* tools help in the data mining processes from loading to transformation, aggregation, automated parameter, and process optimization.

II. COURSE OBJECTIVES

The students will try to learn:

I. The role of business analytics within an organization.
II. The relationships between the underlying business processes of an organization.
III. To gain an understanding of how managers use business analytics to formulate

III COURSE OUTCOMES:

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

CO1	Analyze data using statistical and business analytics technology	Analyze
CO2	Solve business problems and to support managerial decision making	Apply
CO3	Choose business decision Strategies with the without outcome probabilities	Apply
CO4	Perform statistical analysis on variety of data	Apply
CO5	Experiment Data using Business Analytics Technology	Apply

IV. COURSE SYLLABUS:

MODULE – I: BUSINESS ANALYTICS (09)

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

MODULE – II: REGRESSION ANALYSIS (09)

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

MODULE – III: ORGANIZATION STRUCTURES (09)

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

MODULE – IV: FORCASTING TECHNIQUES (09)

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

MODULE – V: DECISION ANALYSIS (09)

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

V. TEXT BOOKS

1. James Evans, "Business Analytics", Persons Education.

VI. REFERENCE BOOKS

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business Analytics Principles, Concepts, and Applications", Pearson FT Press.

VII. WEB REFERENCES

1.http://nptel.ac.in/courses/110107092/

VIII. E-TEXT BOOKS

1.http://nptel.ac.in/downloads/110107092/

REAL TIME OPERATING SYSTEMS

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC30	**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**		

I. COURSE OVERVIEW:

This course is to introduce students with the basic concepts and approaches in the design and analysis of real-time operating systems. It covers design considerations of real time operating systems, task scheduling, threads, multitasking, task communication and synchronization. Applications of the course include real time operating systems in image processing, fault tolerant applications and control systems.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concepts of operating systems and principles of real time operating system, implementation aspects of real time concepts in embedded systems.
II. The design of real time operating system by using the concepts of Timers, I/O subsystem and Memory management units.
III. Software development process and tools like Vxworks and muCOS for real timeoperating system applications.

III. COURSE OUTCOMES:

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

CO1	**Recall** real time operating system to provide resource managementand synchronization for communication systems.	Understand
CO2	**Compare** soft real-time operating system and hard real-timeoperating systems for the priority based task scheduling.	Analyze
CO 3	**Outline** the components of real time operating systems for the designof reliable embedded system.	Understand
CO 4	**Analyze** finite state machine for the task scheduling and execution inkernel models.	Analyze
CO 5	**Develop** a semaphore token for the execution of one or more threadsin mutual exclusion.	Create
CO 6	**Interpret** message queue in asynchronous communications protocolfor send and receive messages simultaneously.	Understand

IV. SYLLABUS:

MODULE – I: REAL TIME OPERATING SYSTEM PRINCIPLES (10)

History of operating systems, defining RTOS, classification of real-time systems, The scheduler, objects, services and key characteristics of RTOS, Tasks: Defining a task, task states and scheduling, typical task operations, typical task structure.

MODULE – II: REAL TIME KERNEL OBJECTS (09)

Semaphores: Defining semaphores, typical semaphore operations, typical semaphore use; Message Queues: Defining message queues, message queue states, message queue content, message queue storage, typical message queue operations; Typical message queue use other kernel objects: Pipes, event registers, signals, condition variables.

MODULE – III: RTOS DESIGN CONSIDERATIONS (08)
Timer and Timer Services: Real-time clocks and system clocks, programmable interval timers, timer interrupt service routines, model for implementing the soft-timer handling facility, timing wheels.
I/O sub system: Basic I/O concepts, the I/O sub system; Memory management: Dynamic memory allocation, fixed-size memory management, blocking vs. Non-blocking memory functions, hardware memory management units.

MODULE – IV: TASKS COMMUNICATION AND SYNCHRONIZATION (08)
Synchronization and Communication: Synchronization, communication, resource synchronization methods, common practical design patterns; common design problems: Resource classification, deadlocks, priority inversion.

MODULE – V: RTOS APPLICATION DOMAINS (10)
Comparison and study of RTOS: Vxworks and COS, Case studies: RTOS for image processing, embedded RTOS for voice over IP, RTOS for fault tolerant applications, RTOS for control systems.

V. TEXT BOOKS:

1. Andrew Troelsen,"Pro C and the .NET 4 Platform, Springer (India) Private Limited, New Delhi, India, 5th Edition, 2010.
2. David Chappell, "Understanding .NET – A Tutorial and Analysis", Addison Wesley, 2nd Edition, 2002.
3. S. Thamarai Selvi, R. Murugesan, A Textbook on C, Pearson Education, 1st Edition, 2003.

VI. REFERENCE BOOKS:

1. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI, 1st Edition, 1999.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Kindle Publishers, 2nd Edition, 2005.
3. Tanenbaum, "Modern Operating Systems", Pearson Edition, 3rd Edition, 2007.

VII. WEB REFERENCES:

1. https://www.jntumaterials.co.in
2. http://www.inf.ed.ac.uk/teaching/courses/es/PDFs/RTOS.pdf
3. https://nptel.ac.in/courses/106108101/pdf/Lecture_Notes/Mod%208_LN.pdf
4. http://wwww.iare.ac.in

VIII. E-TEXT BOOKS:

1. http://www.bookzz.org/
2. http://www.jntubook.com
3. http://www.4shared.com/web/preview/pdf/BhrrT3m0
4. http://www.archive.org

WASTE TO ENERGY

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BPSC30	**Core**	3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

The course is designed to create environmental awareness and consciousness among the present generation to become environmental responsible citizens. The course will discuss on the municipal solid waste composition, characteristics and to improve the methods to minimize municipal solid waste generation. This course deals with methods of disposal of solid waste by thermal biochemical processes and production of energy from different types of waste sand to know the environmental impacts of all types of municipal waste.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The principles of solid waste management in reducing and eliminating dangerous impacts of waste materials on human health and the environment to contribute economic development and superior quality of life.
II. The insight of the design and operations of a municipal solid waste landfill by collection, transfer and transportation of municipal solid waste for the final disposal.
III. The insight of the design and operations of a municipal solid waste landfill by collection, transfer and transportation of municipal solid waste for the final disposal.

III COURSE OUTCOMES:

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

CO 1	**Identify** the different sources and types of solid waste by the properties of municipal solid waste for segregation and collection of waste.	Apply
CO 2	**Illustrate** the classification, preliminary design considerations of landfill and methods of landfill disposal of solid to control greenhouse gases.	Understand
CO 3	**Understand** the Composition, characteristics of leachate to control the emission of gases by monitoring the movement of landfill leachate.	Understand
CO 4	**Outline** the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste.	Understand
CO 5	**Apply** the knowledge in planning and operations of waste to Energy plants by following legal legislation related to solid waste management.	Apply
CO 6	**Illustrate** the thermo-chemical conversion of Biogas by using Gasification process for energy generation.	Understand

IV. SYLLABUS

MODULE –I: WASTE SOURCES & CHARACTERIZATION (09)

Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

MODULE –II: TECHNOLOGIES FOR WASTE TO ENERGY (09)

Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

MODULE –III: WASTE TO ENERGY & ENVIRONMENTAL IMPLICATIONS (09)

Environmental standards for Waste to Energy Plant operations and gas clean-up. Savings on non-renewable fuel resources.

Carbon Credits: Carbon foot calculations and carbon credits transfer mechanisms.

MODULE –IV: THERMO-CHEMICAL CONVERSION (09)

Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion, comparison of various thermo-chemical conversion.

MODULE –V: E- CENTRALIZED AND DECENTRALIZED WASTE TO ENERGY PLANTS (09)

Waste activities – collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications – In-house use – sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry. Centralized and Decentralized Energy production, distribution and use. Comparison of Centralized and decentralized systems and its operations.

V. TEXT BOOKS:

1. Nicholas P Cheremisinoff, "Handbook of Solid Waste Management and Waste Minimization Technologies", An Imprint of Elsevier, New Delhi, 2003.
2. Paul Breeze, "Energy from Waste", An Imprint of Elsevier, New Delhi, 2018.
3. P Aarne V esilind, William A Worrell and Debra R Reinhart, "Solid Waste Engineering", 2nd Edition 2002.

VI. REFERENCE BOOKS:

1. Challal, D S, "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1st Edition, 1991.
2. C Y Were Ko-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1st Edition, 1996.
3. C Parker and T Roberts (Ed), "Energy from Waste", An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
4. KL Shah, "Basics of Solid and Hazardous Waste Management Technology", Prentice Hall, Reprint Edition, 2000.
5. M Datta, "Waste Disposal in Engineered Landfills", Narosa Publishing House, 1997

VII. WEB REFERENCES:

1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. &Engg.-2013 (Publisher: Earthscan 2013)
2. https://www.What is the impact of E-waste: Tamara Thompson
3. https://www. E-waste poses a Health Hazard: SairudeenPattazhy

VIII. E-TEXT BOOKS:

1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. &Engg.-2013 (Publisher: Earthscan 2013)
2. https://www.What is the impact of E-waste: Tamara Thompson
3. https://www. E-waste poses a Health Hazard: SairudeenPattazhy

OPERATIONS RESEARCH

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCCC30	**Elective**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorials Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

Operations Research (OR) is a discipline that helps to make better decisions in complex scenarios by the application of a set of advanced analytical methods. It couples theories, results and theorems of mathematics, statistics and probability with its own theories and algorithms for problem solving. Applications of OR techniques spread over various fields in engineering, management and public systems. This course includes the following topics : Linear Programming, Transportation problems, Assignment and Theory of games problems. Advanced topics on waiting line and simulation.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The description, characteristics of operation research and mathematical model of real time problem for optimization.
II. Establish the problem formulation by using linear, dynamic programming, game theory and queuing models.
III. Apply stochastic models for discrete and continuous variables to control inventory.
IV. Visualize the computer-based manufacturing simulation models.

III. COURSE OUTCOMES:

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

CO1	Recall the basics of operation research	Remember
CO2	Explain the characteristics and scope of OR	Understand
CO3	Select optimal problems solving techniques for a given problem using LP	Apply
CO4	Solve transportation, travelling sales man and Assignment problems	Apply
CO5	Demonstrate and solve simple models of Game theory.	Understand
CO6	Choose appropriate simulation model for practical application	Apply

IV. COURSE SYLLABUS:

MODULE -I: INTRODUCTION AND ALLOCATION (09)

Development, definition, characteristics and phases, types of operation research models, applications;
Allocation: linear programming, problem formulation, graphical solution, simplex method, artificial variables techniques, two–phase method, big-M method.

MODULE -II: TRANSPORTATION AND ASSIGNMENT PROBLEM (09)

Transportation problem: Formulation, optimal solution, unbalanced transportation problem, degeneracy; Assignment problem, formulation, optimal solution, variants of assignment problem, traveling salesman problem.

MODULE -III: SEQUENCING AND REPLACEMENT (09)

Sequencing: Introduction, flow, shop sequencing, n jobs through two machines, n jobs through three machines, job shop sequencing, two jobs through “m” machines.

Replacement: Introduction: Replacement of items that deteriorate with time, when money value is not counted and counted, replacement of items that fail completely, group replacement.

MODULE -IV: THEORY OF GAMES AND INVENTORY (09)

Theory Of Games: Introduction, minimax (maximin) criterion and optimal strategy, solution of games with saddle points, rectangular games without saddle points, dominance principle, mx2 and 2xn games, graphical method; Inventory: Introduction, single item, deterministic models, purchase inventory models with one price break and multiple price breaks, shortages are not allowed, stochastic models, demand may be discrete variable or continuous variable, instantaneous production, instantaneous demand and continuous demand and no set up cost, single period model.

MODULE -V: WAITING LINES AND SIMULATION (09)

Waiting Lines: Introduction, single channel, poisson arrivals , exponential service times, with infinite population and finite population models, multichannel, poisson arrivals, exponential service times with infinite population single channel Poisson arrivals; Simulation: Definition, types of simulation models, phases of simulation, applications of simulation, inventory and queuing problems, advantages and disadvantages, brief Introduction of simulation languages.

V. TEXT BOOKS:

1. J. K. Sharma, "Operations Research", Macmillan, 5th Edition, 2012.
2. R. Pannerselvan, "Operations Research", PHI Publications, 2nd Edition, 2006.

VI. REFERENCE BOOKS:

1. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 1st Edition, 2013.
2. Maurice Saseini, ArhurYaspan, Lawrence Friedman, "Operations Research: Methods & Problems", 1st Edition, 2013.
3. Hamdy A. Taha, "Introduction to O.R", PHI, 8th Edition, 2013.
4. Harvey M.Wagner, "Operations Research", PHI Publications, 2nd Edition, 2013.

VII. WEB REFERENCES:

1. http://people.brunel.ac.uk/~mastjjb/jeb/or/contents.html
2. https://pe.gatech.edu/degrees/online-masters-degrees/operations-research
3. http://nptel.ac.in/courses/112106134/1

VIII. E-TEXT BOOKS:

1. http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_qt.pdf 2_
2. http://www.ggu.ac.in/download/Class-Note14/Operation%20Research07.04.14.pdf

PROJECT MANAGEMENT AND PLANNING

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC30	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

Construction project planning and administration the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality and participation satisfaction. Teaching these requirements by the designed course content.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The construction project schedules, documents for planning and management of construction processes.
II. The various types of planning tools like bar chart, CPM networks and PERT analysis
III. The different methods of project delivery, roles and responsibilities of all constituencies involved in the design and construction process.
IV. The various types of construction contracts, their legal aspects and provisions.

III. COURSE OUTCOMES:

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

CO1	Apply the knowledge of management functions like planning, scheduling, executing and controlling of projects for completion of project within given time.	Apply
CO2	Apply the knowledge of network analysis of construction activities and optimize resources by using bar chart, CPM networks.	Apply
CO3	Apply the knowledge of modern construction practices and techniques to achieve quality of work in projects	Apply
CO4	Identify the resource planning and management in construction to improve the performance management and organizational effectiveness.	Apply
CO5	Understand the computer based models adopted in construction industry for optimization of cost and schedule of a project	Understand
CO6	Identify the different types of contracts in construction, arbitration, legal aspects and provision to safe guard the labor and human rights.	Apply

IV. SYLLABUS

MODULE –I: PROJECT MANAGEMENT (09)

Introduction, Project planning, scheduling, controlling, Role of decision in project management, Project management Process and role of Project Manager.

MODULE –II: PROJECT PLANNING TOOLS (09)

Bar Charts and Milestones Chart: Introduction, Development of bar chart, Short comings and remedial measures, Milestone charts.CPM & PERT: Elements of network, Time estimates, frequency distribution, mean, variance and standard deviation, probability distribution. Network Analysis: Slack, Float, Critical path, crashing of activity.

MODULE –III: COST ANALYSIS & UPDATING (09)

Introduction, Projects cost: Direct cost, Indirect cost, slope of direct cost curve, total project cost and optimum duration, cost optimization.

Project Updating: Introduction, updating process, data required for updating, steps in process updating.

MODULE –IV: RISK ANALYSIS AND RESOURCE ALLOCATION (09)

Certainty, risk and uncertainty, risk management, identification and nature of construction risks, contractual allocation of risk, types of risks, minimizing risks and mitigating losses, use of expected values, utility in investment decisions, decision trees, sensitivity analysis. Resource Allocation: Resource usage profiles, Resource smoothing and levelling.

MODULE –V: CONSTRUCTION EQUIPMENT (09)

Types of compaction Equipment's, Types of Excavation and digging Equipment's, Types of hoisting equipment's, Types of Material handling Equipment's and Types of heavy earth moving equipment's.

V. TEXT BOOKS:

1. B. C. Punmia, K.K. Khandelwal, Project Planning and Control with PERT and CPM, Laxmi Publications, 2005.
2. Sharma S.C. "Construction Equipment and Management, Khanna Publishers, New Delhi, 2002.

VI. REFERENCE BOOKS:

1. Peurifoy,R.L, Ledbetter.W.B and schexnayder,C, "Construction Planning and Equipment methods, McGraw Hill, Singapore, 1993.
2. Callahan,M.T., Quackenbush,D.G.,and rowing,J.E., "Construction Project Scheduling, McGraw Hill, New York, 1998.
3. Cleland, D.I. and Ireland, L.R., "Project Management: Strategic Design and Implementation, McGraw Hill, New York, 2002.

VII. WEB REFERENCES:

1. https://nptel.ac.in/courses/105/106/105106149/
2. https://onlinecourses.nptel.ac.in/noc19_mg30/preview

VIII. E-TEXT BOOKS:

https://books.google.co.in/books/about/Project_Management_Planning_and_Control.html?id=BQa8wudi6AAC&redir_esc=y

ENGLISH FOR RESEARCH PAPER WRITING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC01	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course, students will be equipped with the necessary tools to effectively communicate their research findings in a scholarly manner. They will develop the ability to write clear, concise, and well-structured research papers that adhere to academic standards. These skills will not only benefit them in their academic pursuits but also in their future professional careers as researchers, scholars, and professionals in various fields

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to improve the writing skills and level of readability.
II. The methodology that what to write in each section
III. The skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

III. COURSE OUTCOMES:

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

CO 1	Interpret the technique of determining a research problem for a crucial part of the research study	Apply
CO 2	Examine the way of methods for avoiding plagiarism in research	Understand
CO 3	Apply the feasibility and practicality of research methodology for a proposed project.	Apply
CO 4	Make use of the legal procedure and document for claiming patent of invention.	Apply
CO 5	Identify different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP	Apply

IV. SYLLABUS:

MODULE – I: PLANNING AND PREPARATION (04)

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

MODULE – II: ABSTRACT (05)

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

MODULE – III: DISCUSSION AND CONCLUSIONS (05)

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

MODULE – IV: DISCUSSION AND CONCLUSIONS (05)

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

MODULE – V: QUALITY AND TIME MAINTENANCE (05)

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

V. TEXT BOOKS:

1. Goldbort R, "Writing for Science", Yale University Press. 2011.
2. Adrian Wallwork, "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011.

VI. REFERENCE BOOKS:

1. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM Highman's Book.

VII. WEB REFERENCES:

1. http://saba.kntu.ac.ir/eecd/ecourses/Seminar90/2011%20English%20for%20Writing%20Research%20Papers.pdf

VIII. E-TEXT BOOKS:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

DISASTER MANAGEMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSC02	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In the course on disaster management, students will explore a range of important topics and gain valuable knowledge and skills to effectively address and mitigate the impact of disasters and covers areas like Repercussions of Disasters and Hazards, Disaster-Prone Areas in India, Risk Assessment and Disaster Mitigation

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
II. How critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
III. The understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
IV. The strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

III. COURSE OUTCOMES:

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

CO 1	Understand to describe the basic types of Environmental hazards and disasters. Understand how to react effectively to natural, manmade, and technological threats.	Understand
CO 2	Understand how to react effectively to natural, manmade, and planetary hazards	Understand
CO 3	Explore the history of the field and comprehend how past events are earthquake, landslides, and volcanic hazards.	Analyze
CO 4	Describe the basic concepts of the emergency management cycle mitigation, preparedness, response, and recovery	Understand
CO 5	Recognizes the stakeholders in disaster management system, their jurisdiction and responsibilities	Remember

IV. SYLLABUS

MODULE – I: INTRODUCTION (04)

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types And Magnitude.

MODULE – II: REPERCUSSIONS OF DISASTERS AND HAZARDS (05)

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

MODULE – III: DISASTER PRONE AREAS IN INDIA (05)

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And

Epidemics.

MODULE – IV: DISASTER PREPAREDNESS AND MANAGEMENT (05)

Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

MODULE – IV: RISK ASSESSMENT & DISASTER MITIGATION (05)

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

V. TEXT BOOKS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal Book Company.

VI. REFERENCE BOOKS:

1. Sahni, PardeepEt.Al, "Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
2. Goel S. L. "Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

VII. WEB REFERENCE:

1. http://nptel.ac.in/courses/105101010/downloads/Lecture37.pdf

VIII. E-TEXT BOOKS:

1. Disaster management by Vinod k. Sharma

SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC03	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course, Studying Sanskrit enhances students' analytical thinking and problem-solving abilities. The intricate grammar and logical structure of Sanskrit nurture their analytical skills, enabling them to dissect complex concepts and extract profound insights. This heightened analytical thinking can be applied across different technical disciplines, fostering innovative solutions to contemporary challenges

II. COURSE OBJECTIVES:

The students will try to learn:

I. A working knowledge in illustrious Sanskrit, the scientific language in the world.
II. The Sanskrit to improve brain functioning.
III. The Sanskrit language to develop the logic in mathematics, science & other subjects enhancing the memory power.
IV. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

III. COURSE OUTCOMES:

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

CO 1	Understand the basic Sanskrit grammar	Understand
CO 2	Formulate simple sentences	Apply
CO 3	Apply order and roots	Apply
CO 4	Understand Ancient Sanskrit literature about science & technology	Understand
CO 5	Develop logical thinking being a logical language in technical concepts	Apply

IV. SYLLUBUS:

MODULE – I: INTRODUCTION (06)

Alphabets in Sanskrit, Past/Present/Future Tense.

MODULE – II: SENTENCES (04)

Simple Sentences

MODULE – III: ROOTS (04)

Order, Introduction of roots

MODULE – IV: SANSKRIT LITERATURE (04)

Technical information about Sanskrit Literature

MODULE – V: TECHNICAL CONCEPTS (06)

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

V. TEXT BOOKS:

1. Suresh Soni, “India’s Glorious Scientific Tradition”, Ocean books (P) Ltd., New Delhi.

VI. REFERENCE BOOKS:

1. Dr.Vishwas, “Abhyaspustakam”, Samskrita-Bharti Publication, New Delhi.

VII. WEB REFERENCES:

1. http://learnsanskritonline.com/

VIII. E-TEXT BOOKS:

1. Prathama Deeksha-Vempati Kutumb Shastri, “Teach Yourself Sanskrit”, Rashtriya Sanskri Sansthanam, New Delhi Publication.

VALUE EDUCATION

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC04	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In the course on value education, students emerge with a heightened sense of self-awareness, a strong moral foundation, and the skills necessary for personal and professional success. They are equipped with the knowledge and tools to navigate ethical challenges, contribute positively to society, and lead a purposeful and fulfilling life based on their core values and principles.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The value of education and self- development.
II. Imbibe good values in students.
III. The importance of character.

III. COURSE OUTCOMES:

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

CO 1	Understand the significance of ethical human conduct and self-development	Understand
CO 2	Adopt value-based living and holistic technologies to save nature	Apply
CO 3	Inculcate positive thinking, dignity of labor and religious tolerance	Apply
CO 4	Develop the overall Character and Competence through self-management	Analyze
CO 5	Practice Self-control. Honesty through Studying effectively all religious messages	Apply

IV. SYLLABUS:

MODULE – I: VALUES AND SELF-DEVELOPMENT (04)

Values and self-development. Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

MODULE – II: CULTIVATION OF VALUES (06)

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

MODULE – III: PERSONALITY AND BEHAVIOR DEVELOPMENT (06)

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

MODULE – IV: CHARACTER AND COMPETENCE (04)

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women.

MODULE – V: SELF CONTROL (04)

All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

V. TEXT BOOKS:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

VI. WEB REFERENCES:

1. http://www.best-personal-development-books.com/personal-value-development.html
2. http://nptel.ac.in/courses/109104068/

VII. E-TEXT BOOKS:

1. R.P. Shukla, “Value education and human rights”.

CONSTITUTION OF INDIA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC05	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

The course on the Constitution of India provides students with a comprehensive understanding of the historical context, principles, and structure of the Indian Constitution. It explores the journey and philosophy behind the making of the Indian Constitution, highlighting the vision and ideals of the founding fathers.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The premises informing the twin themes of liberty and freedom from a civil right perspective.
II. The growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
III. The role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

III. COURSE OUTCOMES:

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

CO 1	Describe historical background of the constitution making and its importance for building a democratic India.	Understand
CO 2	Understand the Constitutional Rights and and duties	Understand
CO 3	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary	Understand
CO 4	Analyse the decentralization of power between central, state and local self-government.	Analyze
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy	Apply

IV. SYLLABUS:

MODULE – I: HISTORY OF MAKING OF THE INDIAN CONSTITUTION & PHILOSOPHY OF THE INDIAN CONSTITUTION (08)

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution: Preamble, Salient Features.

MODULE – II: CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES (04)

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

MODULE – III: ORGANS OF GOVERNANCE (04)

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive President, Governor, Council of Minister.

Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

MODULE – IV: LOCAL ADMINISTRATION (04)

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

MODULE – V: ELECTION COMMISSION (04)

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

V. TEXT BOOKS:

1. Dr. S. N. Busi, "Dr. B. R. Ambedkar framing of Indian Constitution", 1st Edition, 2015.
2. M. P. Jain, "Indian Constitution Law", Lexis Nexis, 7th Edition, 2014.

VI. REFERENCE BOOKS:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

VII. WEB REFERENCES:

1. http://www.constitution.org/cons/india/p18.html

VIII. E-TEXT BOOKS:

1. https://www.india.gov.in/my-government/constitution-india/constitution-india-full-text

PEDAGOGY STUDIES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC06	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course in pedagogy studies, students gain a solid foundation in educational principles and practices. They develop a deep understanding of effective teaching and learning strategies, empowering them to create engaging and meaningful learning experiences for their future students. Whether pursuing a career in teaching or any other field that involves knowledge transfer, students emerge with the knowledge and skills to inspire and facilitate learning, making a positive impact on the lives of others.

II. COUSE OBJECTIVES:

The students will try to learn:

I. Review existing evidence on the review topic to inform program design and policy making undertaken by the DFID, other agencies and researchers.
II. The critical evidence gaps to guide the development.

III. COURSE OUTCOMES:

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

CO 1	Identify the Methodology and conceptual framework of teachers education	Understand
CO 2	Understand pedagogical practices are being used by teachers in formal and informal classrooms in developing countries	Understand
CO 3	Interpret the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners	Understand
CO 4	Classify the importance of class room practice, curriculum and learning in Professional Development.	Understand
CO 5	Summarize teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy	Understand

IV. SYLLABUS:

MODULE – I: INTRODUCTION (04)

Introduction And Methodology: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

MODULE – II: THEMATIC OVERVIEW (04)

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

MODULE – III: PEDAGOGICAL PRACTICES (06)

Evidence on the effectiveness of pedagogical practices. Methodology for the in-depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.

Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

MODULE – IV: PROFESSIONAL DEVELOPMENT (05)

Professional Development: alignment with classroom practices and follows up Support. Peer support. Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes.

MODULE – V: RESEARCH GAPS (05)

Research gaps and future directions, Research design**,** Contexts**,** Pedagogy**.** Teacher education**.** Curriculum and assessment**.** Dissemination and research impact.

V. TEXT BOOKS:

1. Ackers J, Hardman F, "Classroom interaction in Kenyan primary schools", Compare, 31 (2), 245-261.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361-379.

VI. REFERENCE BOOKS:

1. AkyeampongK, "Teacher training in Ghana - does it count?" Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving Teaching and Learning of Basic Maths and Rreading in Africa: Does teacher preparation count?" International Journal Educational Development, 33 (3): 272–282.

VII. WEB REFERENCE:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.
2. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education Oxford and Boston: Blackwell

VIII. E-TEXT BOOKS:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

STRESS MANAGEMENT BY YOGA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC07	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In a course on stress management by yoga, engineering students learn a variety of yoga techniques and principles that promote physical, mental, and emotional well-being. These techniques include yoga postures (asanas), breathing exercises (pranayama), meditation, and relaxation techniques.

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to achieve overall health of body and mind.
II. How to overcome stress.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to: (Same as R18)

CO 1	Understand Ashtanga yog and its impartance	Understand
CO 2	Identify the Dos and Do nots of Life by practicing the Yam and Niyam	Analyze
CO 3	Interpret the Shaucha and its components	Understand
CO 4	Make use of breathing techniques and Asan and Pranayam	Understand
CO 5	Develop healthy mind in a healthy body thus improving social health also	Apply

IV. SYLLABUS:

MODULE – I: INTRODUCTION (06)

Definitions of Eight parts of yog. (Ashtanga)

MODULE – II: YAM AND NIYAM (04)

Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha.

MODULE – III: SHAUCHA (05)

Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

MODULE – IV: ASAN AND PRANAYAM (05)

Asan and Pranayam. Various yog poses and their benefits for mind & body

MODULE – V: BREATHING TECHNIQUES (04)

Regularization of breathing techniques and its effects-Types of pranayam

V.TEXT BOOKS:

1. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.

VI.REFERENCE BOOKS:

1. Janardan Swami, "Yogic Asanas for Group Tarining-Part-I", Yogabhyasi Mandal, Nagpur.

VII. WEB REFERENCES:

1. https://americanyoga.school/course/anatomy-for-asana/
2. https://www.yogaasanasonline.com/

VIII. E-TEXT BOOKS:

1. Todd A. Hoover, M. D. D., Ht, “Stress Management by Yoga”.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC08	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course, students delve into various aspects of personal development and self-awareness. They learn techniques to improve self-confidence, self-esteem, and self-awareness, which are vital for thriving in their engineering careers. Students explore their strengths, weaknesses, values, and beliefs, enabling them to develop a clearer understanding of themselves and their goals.

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to achieve the highest goal happily.
II. How a person become with stable mind, pleasing personality and determination.
III. Awaken wisdom in students.

III. COURSE OUTCOMES:

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

CO 1	**Summarize** steps to develop personality with stable mind, pleasing manners and determination.	Understand
CO 2	**Identify** day to day work and duties for developing peace and prosperity as depicted in Geeta.	Analyze
CO 3	**Formulate** the daily life style by depicting the verses from Bhagavatgeetha.	Analyze
CO 4	**Outline** the verses of Shrimad Bhagavad Geetha for holistic development.	Create
CO 5	Demonstrates personality development by verses of Bhagavatgeetha.	Create

IV. SYLLUBUS:

MODULE – I: HOLISTIC DEVELOPMENT (08)

Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue),Verses- 52,53,59 (dont's),Verses- 71,73,75,78 (do's)

MODULE – II: BHAGWAD GEETA (04)

Approach to day to day work and duties. Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48. Chapter 3- Verses 13, 21, 27, 35.

MODULE – III: BHAGWAD GEETA (04)

Shrimad BhagwadGeeta: Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

MODULE – IV: BASIC KNOWLEDGE (04)

Statements of basic knowledge. Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68. Chapter 12 - Verses 13, 14, 15, 16,17, 18

MODULE – V: ROLE MODEL (04)

Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,

Chapter 4-Verses 18, 38,39. Chapter18 – Verses 37,38,63

V. TEXT BOOKS:

1. P.Gopinath, "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", Rashtriya Sanskrit Sansthanam, New Delhi.

VI. REFERENCE BOOKS:

1. Swami Swarupananda, "Srimad Bhagavad Gita", Advaita Ashram (Publication Department), Kolkata.

VII. WEB REFERENCES:

1. http://openlearningworld.com/section_personality_development.html

VIII. E-TEXT BOOKS:

1. http://persmin.gov.in/otraining/UNDPProject/undp_UNITs/Personality%20Dev%20N%20DLM.pdf

BUSINESS SUSTAINABILITY MANAGEMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC09	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course student will be able to learn sustainability management, business sustainability dimensions, paradigms of business sustainability, sustainability management knowledge and methods.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The sustainability challenges and opportunities in the global economy.
II. The design, technology and planning for sustainability.
III. The regulatory environment and international policies for sustainability.
IV. The contemporary paradigms of business sustainability.
V. The design, technology and planning for sustainability management.

III. COURSE OUTCOMES:

After successful completion of the course, students shouldbe able to:

CO 1	Understand sustainability challenges and opportunities in the global economy	Understand
CO 2	explore opportunities for value creation through stakeholder and partner collaboration	Understand
CO 3	Investigate the potential of technology, design, and innovation to enable or limit sustainable business practices.	Understand
CO 4	Understand product sustainability life cycle and management	Understand
CO 5	Develop proactive plans for enhancing sustainability and resilience of Corporate firms.	Apply

IV. SYLLABUS:

MODULE – I: INTRODUCTION TO SUSTAINABILITY MANAGEMENT (06)

Definition, nature and characteristics of sustainability management, history of sustainability management, future of sustainability management, sustainability and environmental management, emerging trends in sustainability.

MODULE – II: BUSINESS SUSTAINABILITY DIMENSIONS (04)

Dimensions of Sustainability, Challenges Facing Business, Stakeholders and Stakeholder Management Issues in Sustainability management, sustainability management approaches.

MODULE – III: EMERGING PARADIGMS OF BUSINESS SUSTAINABILITY (06)

Managing sustainability – functional responses, strategy and leadership issues, linkages with External Stakeholders.
Reporting, Measurements and Standards, Emerging Business Issues in Sustainability.

MODULE – IV: PRODUCT SUSTAINABILITY MANAGEMENT (04)

Life Cycle Thinking, Environmental Life Cycle Assessment, Life Cycle Costing Sustainable Procurement, Supply Chain Sustainability, Product Stewardship, Extended Producer Responsibility.

MODULE – V: SUSTAINABILITY MANAGEMENT KNOWLEDGE AND METHODS (04)

Sustainability Business Modeling and the Circular Economy, Impact measurement and Valuation, Digitalization, Data and Sustainability, Sustainability communication, Corporate sustainability management.

V. TEXT BOOKS:

1. Margaret Robertson, "Dictionary of Sustainability", Routledge, 16th May 2017.
2. Jane Penty, "Product Design and Sustainability Strategies, Tools and Practice", Routledge, 27th August, 2019.
3. John Blewitt, "Understanding Sustainable Development", Routledge, 22nd December 2017.

VI. REFERENCE BOOKS:

1. Margaret Robertson, "Sustainability Principles and Practices", Routledge, 10th February, 2021.
2. RikiTherivel, Graham Wood, "Methods of Environmental and Social Impact Assessment", Routledge, 14th September, 2017.
3. NikoRooda, "Fundamentals of Sustainability Development", Routledge, 30th September, 2020.

VII. WEB REFERENCES:

1. https://www.slideshare.net/PresentationLoad/sustainability-management-ppt-slide-template
2. https://www.slideshare.net/szl/sustainable-development-management
3. https://www.slideshare.net/eccinternational/corporate-sustainability-management

VIII. E-TEXT BOOKS:

1. https://about.jstor.org/librarians/books/sustainability/
2. http://www. ebooktake.in/pdf/title/sustainability management
3. http://all4ryou.blogspot.in/2012/06/becg-sustanability development
4. http://books.google.com/books/about/ corporate sustainability management

BUSINESS ETHICS AND CORPORATE GOVERNANCE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC10	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW

In this course students will be able to learn business ethics, ethical value system, conceptual framework of corporate governance, corporate social responsibility

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Business Ethics and to provide best practices of business ethics codes.
II. The values and implement in their careers to guide beliefs, attitudes, and behaviors.
III. The corporate social responsibilities and practice in practical and professional life.
IV. The ethical issues in corporate governance and to adhere to the ethical.
V. The legal framework to protect the ethical practices of organizations.

III. COURSE OUTCOMES:

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

CO 1	understand the business ethics and explore the relationship between ethics and business and economics across different cultural traditions.	Understand
CO 2	Comprehend the relationship between ethics, morals and values in the workplace.	Understand
CO 3	Analyze and understand various ethical philosophies to explain how they contribute to current management practices.	Analyze
CO 4	Analyze the reasons of systematic failure of corporate governance that could spread from individual firms to entire markets or economies.	Analyze
CO 5	Analyze corporate social Responsibility	Analyze

IV. SYLLABUS:

MODULE – I: INTRODUCTION TO BUSINESS ETHICS (06)

Meaning, Principles of Business Ethics, Characteristics of Ethical Organization, Ethics, Ethics of Corporate Governance, Globalization and Business Ethics, Stakeholders' Protection, Corporate Governance and Business Ethics.

MODULE – II: THE ETHICAL VALUE SYSTEM (04)

Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

MODULE – III: LAW AND ETHICS (06)

Relationship between Law and Ethics, Other Bodies in enforcing Ethical Business Behavior, Impact of Laws on Business Ethics; Social Responsibilities of Business.

Environmental Protection, Fair Trade Practices, Fulfilling all National obligations under various Laws, Safeguarding Health and wellbeing of Customers.

MODULE – IV: CONCEPTUAL FRAMEWORK OF CORPORATE GOVERNANCE (04)

Meaning, Governance vs. Good Corporate Governance, Corporate Governance vs. Corporate Excellence, Insider Trading, Rating Agencies, Benefits of Good Corporate Governance, Corporate Governance Reforms, and Initiatives in India.

MODULE – V: CORPORATE SOCIAL RESPONSIBILITY (04)

Meaning, CSR and Corporate Sustainability, CSR and Business Ethics, CSR and Corporate Governance, Environmental Aspect of CSR, CSR Models.

V. TEXT BOOKS:

1. J. P. Sharma, "Corporate Governance, Business Ethics & CSR", Ane Books Pvt. Ltd., New Delhi.
2. Bhanu Murthy, K. V. and Usha Krishna, "Politics Ethics and Social Responsibilities of Business", Pearson Education, New Delhi.
3. D Geeta Rani & R K Mishra, "Corporate Governance-Theory and Practice", Excel Books, New Delhi

VI. REFERENCE BOOKS:

1. Christine A Mallin, "Corporate Governance (Indian Edition)", Oxford University 46 Press, New Delhi.
2. Bob Tricker, "Corporate Governance-Principles, Policies, and Practice (Indian Edition)", Oxford University Press, New Delhi.
3. Andrew Crane Dirk Matten, "Business Ethics (Indian Edition)", Oxford University Press, New Delhi.

VII. WEB REFERENCES:

1. https:// www.slideshare.net/glory1988/business-ethics-corporate -governance
2. https:// thenthata.web4kurd.net/mypdf/ethics-corporate-governance
3. https:// bookshallcold. link/pdfread/business-ethics-corporate-governance
4. https:// www.gvpce.ac.in/syllabi/corporate social responsibility/

VIII. E-Text Books:

1. https:// books.google.co.in/books/about/business ethics and corporate governance
2. http://www. ebooktake.in/pdf/title/laws and ethics
3. http://all4ryou.blogspot.in/2012/06/becg-business ethics
4. http://books.google.com/books/about/business corporate governance

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. Who grants Autonomy? UGC, Govt., AICTE or University

In case of Colleges 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 Colleges.

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 College?

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 College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4. How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

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 college 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 College 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 college 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 college 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 college will therefore represent better employability.

11. What is the proportion of Internal and External Assessment as an Autonomous College?
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 have 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.

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

Where, C_i is the number of credits of the i^{th} course and $G_i$is the grade point scored by the student in the i^{th} 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 i^{th}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 make up 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 College to keep and preserve all the records.

30. What is our relationship with the JNT University?
We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

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 college 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 College 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 2021-2022 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 college.
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 college 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 college campus.
10. If I absent myself continuously for 3 days, my parents will have to meet the concerned HOD / Principal.
11. I hereby acknowledge that I have received a copy of PG21 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