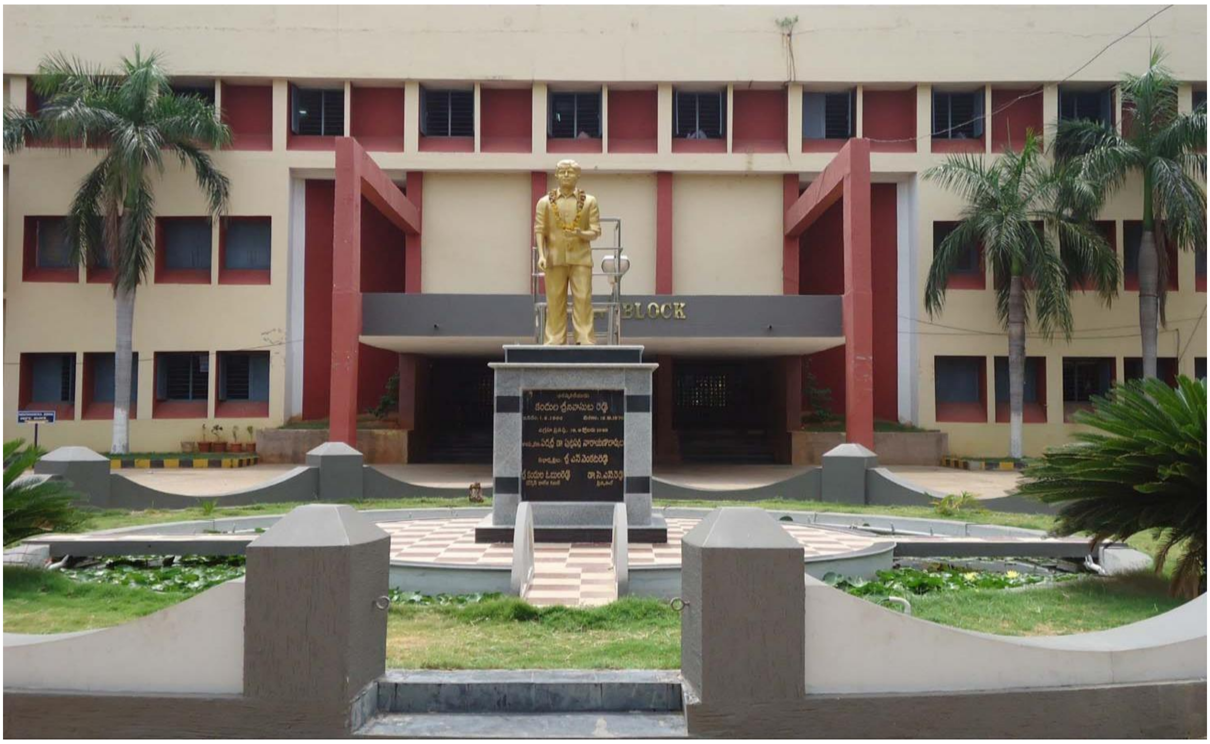
Regulations, Curriculum and Syllabus for

UG Programs in Engineering (R20UG)

(Effective from 2020-21 for Regular students and from 2021-22 for Lateral Entry students)

ELECTRONICS AND COMMUNICATION ENGINEERING



Kandula Srinivasa Reddy Memorial College of Engineering
(Autonomous)
Kadapa 516005, AP
(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC) (An ISO 9001-2008 Certified Institution)

KSRM COLLEGE OF ENGINEERING (AUTONOMOUS)
VISION & MISSION

VISION:

To evolve as center of repute for providing quality academic programs amalgamated with creative learning and research excellence to produce graduates with leadership qualities, ethical and human values to serve the nation.

MISSION:

M1: To provide high quality education with enriched curriculum blended with impactful teaching-learning practices.
M2: To promote research, entrepreneurship and innovation through industry collaborations.
M3: To produce highly competent professional leaders for contributing to Socio-economic development of region and the nation.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION & MISSION

VISION:

To emerge as globally recognized department in the frontier areas of Electronics and Communication Engineering

MISSION:

M1: To imbibe experiential, lifelong learning skills and problem solving capabilities through enriched curriculum and innovative teaching learning practices.

M2: To promote quality research by strengthening industry collaborations.

M3: To inculcate entrepreneurial attitude, leadership skills, human values and professional ethics.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1: To apply the concepts of electronics, communication and computation and pursue career in core and allied industries to solve industrial and societal problems.

PEO2: To pursue higher education to progress professionally in contemporary Technologies and multidisciplinary fields with an inclination towards continuous learning.

PEO3: To exhibit professional skills, ethical values, interpersonal skills, leadership abilities, team spirit and lifelong learning.

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Program Outcomes:

PO1 - Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 - Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 - Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 - Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 - Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 - The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

PO7 - Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 - Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO9 - Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 - Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 - Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 - Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES:

The Program Outcomes after successful completion of B.Tech ECE program are,

PSO1: An ability to design electronic circuits for applications including signal processing, communications, computer networks, Embedded systems and in the field of VLSI.

PSO2: Develop innovative technologies for Entrepreneurship with new cutting edge Technologies in the fields of electronic design, communication and automation.

PSO3: Identify and Apply Domain specific tools for Design, Analysis and Synthesis in the areas of Signal Processing, Communications, VLSI and Embedded systems.

KSRM College of Engineering (Autonomous), Kadapa-516005, A.P.

Regulations for UG Programs in Engineering
(R20UG)(Effective from 2020-21)

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KSRM College of Engineering (Autonomous), Kadapa-516005, A.P.

Regulations for UG Programs in Engineering

(R20 UG) (Effective From 2020-21)

1.0 Nomenclature

1.1 *Academic Year*: Period of academic instruction of, approximately, one year durationthat usually starts in June/July and ends in April/May next

1.2 *Semester*: Either of two divisions of an academic year

1.3 *Major*: A specific field of study. Example: Civil Engineering

1.4 *Minor*: An area outside of, or complementary to, a Major. Example: For CivilEngineering major, Computer Science is a minor and vice versa

1.5 *Subject*: An area of knowledge that is studied as part of a Course

1.6 *Core*: A subject that is mandatory for a Major course of study

1.7 *Elective*: A subject that is selected for study to suit one’s individual needs

1.8 *Mandatory Subject*: A subject that is studied to meet certain requirements but has nocredits assigned to it

1.9 *Humanities subjects*: Subjects that describe and interpret human achievements, problems and historical changes at individual and societal levels covering the disciplines of literature, history, and philosophy.

1.10 *Social Sciences*: Subjects that describe the mental and behavioural activities of individuals, groups, organizations, institutions, and nations covering the disciplines of anthropology, economics, linguistics, political science, and psychology

1.11 *Exam*: A test to measure one’s progress, knowledge, or ability in a subject

1.12 *Credit*: A numerical weight given to a subject, usually based on quantum of academic work

1.13 *Grade*: A numerical or alphabetic designation measuring the level of achievement in an exam.

1.14 *Attendance*: Physical presence of oneself in a classroom/laboratory for purpose of ascheduled academic instruction

1.15 *Course*: A series of subjects that constitute a Major field of study

1.16 *Branch*: Same as Course

1.17 *Program*: Same as Course

1.18 *Degree*: An academic title conferred to honour distinguished achievement

1.19 *Minor Degree*: An Academic honour conferred on achieving 20 extra credits in one'sminor area of study

1.20 *Honours*: An Academic honour conferred on achieving 20 extra credits in one'smajor area of study.

2.0 Short Title and Application

2.1 These rules and regulations may be called as R20UG and come into force from Academic Year 2020-21 and exists until superseded by new regulations. These rules are applicable for students who join the institute from academic year 2020-21 onwards. Students who have joined in earlier regulations will continue in their respective regulations.

2.2 These rules and regulations are applicable to all under graduate courses in engineering and technology leading to Bachelor's Degree in Technology (B. Tech)

2.3 The Major courses offered, at present, are:

2.3.1 Civil Engineering
2.3.2 Electrical and Electronics Engineering
2.3.3 Mechanical Engineering
2.3.4 Electronics and Communication Engineering
2.3.5 Computer Science and Engineering

2.4 The Institute may offer new Majors in future to which these rules and regulationswill be applicable.

3.0 Suspension and Amendment of Rules

3.1 Academic Council has the authority to suspend a rule temporarily.

3.2 Academic Council has the authority to amend a rule.

3.3 For affirmative action on any suspension or amendment of a rule, an affirmative vote of three-fifths of the members present and voting shall be required in Academic Council.

4.0 Requirements for Admission

4.1 At present, admissions into first-year class of various Majors are governed by Government and the Affiliating University. The eligibility criteria and procedure for admissions are prescribed by Government and Affiliating University.

4.2 A student is not allowed change of Major after admission into first-year.

4.3 A student must fulfil medical standards required for admission.

4.4 The selected students are admitted into first-year class after payment of the prescribed fees.

5.0 Structure of the B. Tech course

5.1 *Duration*: The duration of B. Tech degree course is eight semesters spread over fouracademic years. Semesters are named sequentially from First Semester to Eighth Semester.

5.2 *Working Days*: Calendar for any semester shall be announced at least four weeks before its commencement. Minimum number of working days shall be 90 for any semester.

5.3 *Curriculum*: Each major shall have core, elective and mandatory subjects drawn from six categories of subject areas - i) Basic Sciences (BSC), ii) Humanities and Social Sciences including Management Courses (HSMC), iii) Engineering Science Courses (ESC), iv) Professional Core Course (PCC), v) Professional Elective Course (PEC), and vi) Open Elective Course (OEC). The curriculum for eachbranch shall be approved by its corresponding Board of Studies and Academic Council.

5.4 *Credits*: All subjects that are assessed for marks have credits assigned to them. Thecredits assigned to subjects shall be given in curriculum. The total number of creditsfor entire course is 160 for all branches.

5.5 *Curriculum and Syllabus*: The curriculum and syllabus for first and second semestersis given in Annexure-1 and Annexure-2 respectively.

5.6 *Medium of Instruction*: The medium of instruction, examinations and all other related activities is English.

5.7 *Responsibility and Advising*: It is the responsibility of the student to understand and know the regulations and requirements to earn the degree. Each student admitted into the degree programs is assigned to a Faculty Advisor who assists the student indesigning an effective program of study. Students should consult their Faculty Advisors for selection of electives and for general advice on academic program.

5.8 *Gap-Year*: Outstanding students who wish to pursue entrepreneurship are allowedto take a break of one year at any time after II Year / III Year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. College Academic Council shall evaluate the proposal submitted by the student and decide on permitting the student for availing the gap-year. Gap- year can be availed once in the entire course.

6.0 Registration and Enrolment

6.1 Prior to start of each semester, every student shall register for all the subjects listedin curriculum and additional subjects required for achieving honours/ minor degree. Excepting first semester, the registration for a semester shall be done duringa specified week after end examinations of previous semester. In first semester, theregistration shall be done within six working days from date of joining. Recommendation of Faculty Advisor is needed for registration.

6.2 A student can register utmost 8 theory subjects, including mandatory subjects, in any semester.

6.3 Late registration will be permitted with a fine, decided from time to time, up to sixworking days from the last date specified for registration.

6.4 A student will be eligible for registration for a semester if she or he i) is promoted tothat semester, ii) has cleared all fees to the Institute, library and hostel of previoussemester, and iii) is not disqualified for registration by a disciplinary action.

6.5 A student will be enrolled and allowed to attend the classes on successful registration and payment of necessary fees to Institution, library, and hostel.

6.6 Registration and enrolment will be controlled by the Office of the Controller of Examinations.

7.0 Assessment Procedure – Internal Tests and End Examinations

7.1 Performance of students in all subjects is assessed continuously through assignments, internal assessment tests and an End examination.

7.2 Allocation of internal assessment and End examination marks

7.2.1 For theory subjects, the allocation is 40 marks for internal assessment and60 marks for End examination totalling 100 marks.

7.2.2 For laboratory/drawing/project work subjects, the allocation is 40 marks forinternal assessment and 60 marks for End examination totalling 100 marks.

7.2.3 For seminar/industrial training/internship subjects, the allocation is 100 marks for internal assessment. There is no end examination for these subjects.

7.2.4 For mandatory subjects the allocation is 40 marks for internal assessment and no allocation for End examination. These marks are specified for purpose of clause 9.3, and do not account for any credits.

7.3 Internal Assessment

7.3.1 Internal assessment means performance evaluation of students by faculty members who teach the subjects.

7.3.2 *Guidelines*:

a) *Allocation*: For theory subjects including mandatory subjects the total internal assessment marks is 40 of which 30 marks are assessed through midterm tests, 5 marks by surprise or sudden quiz and 5 marks by assignments. The faculty members of the concerned subject will assess themarks in the midterm tests and assignments.

b) *Midterm tests*: Each midterm test will be of 90 minutes duration and evaluated for 30 marks. Internal assessment marks for midterm tests will be calculated as weighted sum of the two midterm test marks, with 80% weight for the best and 20% weight for the other marks. Internal assessment marks for assignments is calculated as the average of all assignments. Total internal marks are the sum of midterm tests, surprise orsudden quiz and assignments assessment marks.

If any student abstains for any midterm test, she or he will be awarded zeromarks for that midterm test. If any student fails to submit any assignmentwithin the specified deadline, she or he will be awarded zero marks for thatassignment.

i. *Number and duration*: There shall be two midterm tests each with a duration of 90 minutes.
ii. *Format of test and division of marks*: Internal test shall consist of only descriptive part for 30 marks.
iii. *Descriptive or Subjective part*: Subjective part shall contain three questionsand all questions shall be answered. However, each question can have internal choice (either or type question). Generally, each question shall testone Course Outcome (CO).
iv. *Syllabus*: Each test shall cover 50% of the syllabus, approximately.

c) *Assignments*: The assignments shall aid and hone the daily routine of students. Assignments shall be stimulating and thought provoking to the student. Whilesome questions may test student's understanding of the subject, there shall bequestions that imply connect to real world applications. A variety of questionscan posed in assignments.

i. *Number:* A minimum of four assignments shall be given in each subject with one assignment from Unit I to IV of syllabus of that subject.
ii. *Quantum of work*: An assignment shall take about four to six hours of study / work per week. Assignments shall not be overloaded nor under loaded. As a guideline, each assignment may contain five questions, each question taking an hour to answer.
iii. *Marks*: Each assignment must be evaluated for fifty marks. Final marks areobtained by averaging all the assignment marks and reducing it to five marks.
iv. *Deadlines*: Students shall be given at least one-week time to complete and submit assignments. Assignments shall be submitted within deadline. Latesubmissions should be awarded zero marks.
v. *General*: It is advised to administer assignments using Google Classroom.

d) *Quiz*: The concerned faculty has to conduct 8 surprise quiz exams in the regular class itself. From each unit two quiz exams shall be conducted and each quiz is for 10 marks. Out of 8 quizzes 6 best quizzes shall be considered and average of 6 quizzes will be reduced to 5 marks. Each quiz can be fill in the blanks or single sentence answer or definitions.

7.3.3 For laboratory/practical/drawing subjects, the internal assessment will be based on regular laboratory work over full semester. The assessment will bedone by the faculty concerned. The students shall be informed sufficiently early of the procedure to be followed for internal assessment.

7.3.4 For subjects like seminar, project-work, industrial training/internship, andcomprehensive viva-voce, the internal assessment will be done by a Department Committee consisting of two senior faculty members and faculty guide of concerned student. The assessment procedure will be informed sufficiently early to the students.

a) *Mandatory internships*: University Guidelines shall apply.
b) *Evaluation of internships*: Shall be evaluated through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the department committee. The report and the oral presentation shall carry 40% and 60% weightages respectively.
c) *Final Semester Internship*: A student should mandatorily undergo internship (University Guidelines shall apply) and should work parallelly on a project. At the end of the semester the candidate shall submit an internship completion certificate and a project report. The project report shall be evaluated with an external examiner.

7.3.5 After the course work is over, the student is permitted to improve his/her internal marks of any 3 theory subjects in the entire course. However he/she will have to attend the course work.

7.4 End examinations

7.4.1 End examinations shall be conducted after completion of coursework in each semester. End exams assessment is for 60 marks. The question paper contains 5 questions and all questions shall be answered. Each question have internal choice (either or type question). Each question carries 12 marks.

7.4.2 The question papers for theory subjects shall be set by faculty members outside of the Institute. The external faculty members for question paper setting shall be appointed by the Principal.

7.4.3 Evaluation of answer scripts shall be done by either Internal or External examiners appointed by the Principal. A minimum of 50% of subjects will beevaluated by external examiners.

7.4.4 For laboratory subjects, end examination shall be conducted by a committee consisting of two internal examiners. One examiner shall be appointed by Head of Department of concerned Major, and the other examiner shall be appointed by the Principal.

7.4.5 For project work viva-voce, end examination shall be conducted by a committee consisting of one internal examiner, one external examiner, and the concerned guide of the student. Internal examiner shall be appointed by Head of Department of concerned Major, and the external examiner shall be appointed by the Principal.

7.4.6 If a student abstains from End examination of any subject, for any reason, sheor he shall be marked as "ABSENT" in that subject.

7.4.7 There is no end examination for mandatory subjects.

8.0 Method of Assigning Letter Grades and Grade Points

8.1 For all credit-bearing subjects, performance of a student in a subject is indicated bya letter grade that corresponds to absolute marks earned in that subject. Each lettergrade is assigned a numeric Grade Point that is used to compute Grade Point Average on a scale of 0 to 10.

8.2 Performance of a student in both internal assessment and End examination will beconsidered for awarding grades for credit bearing subjects. Total marks earned in asubject is the sum of marks obtained in internal assessment and End examination in that subject.

8.3 Pass grade S to E is assigned to a subject based on total marks earned in that subject provided that a student earns at least i) 35% of marks in End examination,and ii) 40% of marks in internal assessment and End examination put together; otherwise fail grade F will be assigned to that subject.

8.4 Grade I will be assigned to a subject if a disciplinary action is pending and is not resolved before publication of results. Office of Controller of Examinations shall resolve the pending disciplinary action within six working days from the date of publication of results and change the grade to any of S to F.

8.5 Grade *Ab* will be assigned to a subject if a student abstains for End examination ofthat subject.

8.6 The absolute marks and corresponding letter grade and grade points are given in Table 1.

Table 1: Letter Grades and Grade Points

Absolute Marks	Letter Grade	Grade Points assigned	Remark
$\geq$ 90	S (Outstanding)	10	Pass
80 - 89	A (Excellent)	9	Pass
70 - 79	B (Very Good)	8	Pass
60 - 69	C (Good)	7	Pass

50 - 59	D (Average)	6	Pass
40 - 49	E (Below Average)	5	Pass
< 40	F (Fail)	0	Fail
Absent	Ab (Absent)	0	Fail
-	I	0	Result Withheld

8.7 *SGPA*: Semester Grade Point Average indicates the performance of a student in allcredit-bearing subjects of a semester. SGPA is calculated as the weighted average ofGrade Points of all subjects of the semester with corresponding credits of subjects as weights. Audit and Self-study subjects are not considered for SGPA calculation

$$SGPA = \frac{\sum GP_i \times CR_i}{\sum CR_i}$$

where GP_i = Grade Point earned in a subjectand CR_i = Credits allocated for that subject

8.8 *CGPA*: Cumulative Grade Point Average indicates the performance of a student in all semesters up to and including the current semester under consideration. CGPAis calculated as the weighted average of SGPAs with total credits in each semester as the weights.

$$CGPA = \frac{\sum S_i \; X \; TC_i}{\sum TC_i}$$

where S_i = SGPA obtained in a semesterand TC_i = Total Credits for that semester

8.9 As per AICTE regulations, conversion of CGPA into equivalent percentage is asfollows:

Equivalent Percentage = (CGPA – 0.50) □ 10

8.10 In *SGPA / CGPA* calculations credits earned towards honours / minor degree will not be counted.

8.11 *Grade Card*: All students shall be issued Grade Cards after the publication of results of a semester. Grade Card is a statement of performance of a student in a semester. It contains information about each registered subject: type of subject, allocated credits, and letter grade earned. SGPA and CGPA will also be indicated.

9.0 Requirements for Completing Subjects

9.1 A student shall complete all credit-bearing and mandatory subjects successfully tobe eligible for award of degree.

9.2 *Credit-bearing subjects*: A student is considered to have completed a credit-bearing subject successfully and earned credits if she or he obtains a pass grade from S to Ein that subject. If a student receives fail grade F or *Ab* in any subject, she or he mustregister for supplementary End examination for that subject as and when opportunity arises and improve grade to pass grade.

9.3 *Mandatory subjects*: A student is considered to have successfully completed a mandatory subject if she or he earns at least 40% of internal assessment marks in that subject.

9.4 *Supplementary exam for mandatory subjects*: If a student fails in mandatory subject, she or he shall register for supplementary examination in that subject as and when theopportunity arises and pass that subject. The supplementary exam will be conducted for 30 marks covering the entire syllabus and student is deemed to havepassed in the subject if she or he earns 12 marks (40% marks) in the supplementaryexam, disregard of her or his performance in assignments and internal tests.

10.0 Requirements for taking End Examinations and Promotion

10.1 A student is eligible to take regular End Examinations of current semester if she orhe fulfils the attendance requirement.

10.2 A student shall be promoted from current semester to succeeding semester onsatisfying the attendance and total credits-earned requirements.

10.3 Attendance Requirement

10.3.1 Attendance of students shall be recorded for credit-bearing and mandatory subjects as per the work load indicated in curriculum.

10.3.2 Total class-periods conducted shall be reckoned from beginning to end of asemester as published in academic calendar.

10.3.3 Aggregate Percentage of Attendance is calculated using total number of class-periods attended as numerator and total number of class-periodsconducted for the concerned semester as the denominator.

10.3.4 A minimum aggregate attendance of 75% is required for promotion to succeeding semester and be eligible to take End examinations of current semester. In addition, student has to acquire a minimum of 40% attendancein each subject.

10.3.5 A student can appeal to the Principal for condoning deficiency in aggregate attendance if she or he gets an aggregate attendance of 65% or more but lessthan the required 75%, presenting a valid reason for deficiency. Such a student will be granted promotion if the Principal pardons the deficiency. Principal has the right to reject the appeal if he/she is not satisfied with theperformance of the student or the reason cited for deficiency of the attendance.

10.3.6 A student earning less than 65% aggregate attendance will be denied promotion. A student who is not promoted on basis of attendance shall be removed from the rolls and shall register for the same semester when opportunity arises. The current semester record of the student is cancelled automatically.

10.4 Credits-Earned Requirement

10.4.1 This rule is applicable for promotion of a student from fourth semester to fifth semester and from sixth semester to seventh semester.

10.4.2 A student who is denied promotion for want of requisite credits shall take supplementary examinations, as and when offered, and earn credits to be eligible for promotion.

10.4.3 Subjects registered for honours/minor degree shall not be considered towards credits-earned requirement.

10.4.4 For promotion from fourth semester to fifth semester, a student must earn atleast 40% credits (rounded to lower integer) from first semester to third semester subjects. A student will get the following opportunities to pass the subjects:

First semester subjects	: One regular and three supplementary exams
Second semester subjects	: One regular and two supplementary exams
Third semester subjects	: One regular and one supplementary exam

10.4.5 For promotion from sixth semester to seventh semester, a student must earn at least 40% credits (rounded to lower integer) from first semester to fifth semester subjects. A student will get the following opportunities to pass the subjects:

First semester subjects	: One regular and five supplementary exams
Second semester subjects	: One regular and four supplementary exams
Third semester subjects	: One regular and three supplementary exams
Fourth semester subjects	: One regular and two supplementary exams
Fifth semester subjects	: One regular and one supplementary exam

11.0 Revaluation of End Examination Scripts

11.1 Revaluation of End Examination scripts is allowed for theory subjects only by paying requisite fee.

11.2 Procedure for Revaluation: The script will be revaluated by an examiner appointed by the Principal. The maximum of revaluation and regular end examination marks will be awarded for that subject.

11.3 A student can apply for revaluation in a subject only once.

12.0 Supplementary End Examinations

12.1 Students are eligible to take Supplementary examinations in subjects with fail gradeeither F or *Ab* only.

12.2 Supplementary examinations for even semester subjects will be conducted along with regular examinations of odd semester subjects.

12.3 Supplementary examinations for odd semester subjects will be conducted along with regular examinations of even semester subjects.

12.4 For eighth semester, special supplementary examinations will be conducted in second week following the results publication date of regular examination of eighthsemester.

13.0 Requirements for Award of B. Tech degree

13.1 Time Limit for completion of requirements for award of degree is eight academic years including gap-year from the date of admission. A student who could not complete all the requirements in this time limit shall forego admission and will beremoved from the rolls of the Institute.

13.2 A student shall be eligible for award of B. Tech degree provided she or he has:

13.2.1 Registered and successfully completed all required credit-bearing and mandatory subjects with a total of 160 credits

13.2.2 Secured a CGPA of 4.5 or more

13.2.3 Cleared all dues to the Institute, library and hostel

13.2.4 No disciplinary action is pending against her or him

13.2.5 Satisfied any other stipulation of the affiliating university.

13.3 *Award of Class*: Each student will be given class in degree based on CGPA asfollows:

Table 2: Class of Degree

Class of Degree	Range of CGPA
Pass Class	>= 4.5 but <5.5
Second Class	>= 5.5 but <6.5
First Class	>= 6.5 but <7.5
First Class with Distinction	>= 7.5

13.4 *Degree with Honours designation*: Students with higher learning capabilities are encouraged to opt for Honours designation. Degree with Honours imply a higher level of academic achievement. A student can earn B.Tech degree with honours designation by meeting the following requirements

13.4.1 Honours designation is optional. A student can opt for either Honours designation or Minor degree (clause 13.5) but not both.

13.4.2 *Entry eligibility*: Students shall apply for Honours designation at the beginning of the fourth semester. Eligibility criteria are (i) minimum CGPA of 8.0 and (ii) no backlogs, reckoned up to second semester. The Chairperson of the concerned Board of Studies will process the applications and publish the list of eligible students.

13.4.3 *Additional course work*: Students shall complete an additional 20-credits coursework, in addition to 160 regular credits, in her/his own major during fifth to seventh semesters. The Board of Studies (BoS) of the concerned major shall specify the list of advanced elective subjects for the purpose of honours designation.

Out of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through twoMOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the BoS.
If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by theconcerned Head of the department in consultation with BoS.
If a student drops or is terminated from the Honours program, the additional credits earned so far will remain extra. These additional courses will find mention in the transcript but not in the degree certificate.

13.4.4 *Registration and enrollment*: Clause 6.0 shall apply

13.4.5 *Evaluation*: The evaluation shall be as per clause 7.0

13.4.6 *Continuous performance*: Students shall earn a minimum SGPA of 8.0 in allsemesters, from fourth to seventh, and without backlogs to be eligible for award of Honours designation. Regular and additional subjects shall be considered for SGPA calculation. If a student does not get a minimum SGPA of 8.0 or fails in any subject during fourth to seventh semesters, she/he will lose candidature for honours designation.

13.5 *Minor Degree designation*: Students with higher learning capabilities are encouraged to opt for Minor degree designation. Minor degree imply a higher level of academic achievement and improves employability. A student can earn minor degree designation by meeting the following requirements.

13.5.1 Minor degree is optional. A student can opt for either Minor degree or Honours designation (clause 13.4) but not both.

13.5.2 *Entry eligibility*: Students shall apply for minor degree at the beginning of fourth semester. Eligibility criteria are (i) minimum CGPA of 8.0 and (ii) no backlogs, reckoned up to second semester.

The Chairperson of the concerned Board of Studies (minor department) will process the applications and publish the list of eligible students.

13.5.3 *Additional coursework*: Students shall complete an additional 20-credits coursework, in addition to 160 regular credits, in selected minor program during fourth to seventh semesters. The Board of Studies (BoS) of the concerned minor program shall specify the list of core and elective subjects for the purpose of minor degree. Out of the 20 credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS and must pursue atleast 2 courses through MOOCs.

13.5.4 *Registration and enrollment*: Clause 6.0 shall apply.

13.5.5 *Evaluation*: The evaluation shall be as per clause 7.0.

13.5.6 *Continuous performance*: Students shall earn a minimum SGPA of 8.0 in all semesters, from fourth to seventh, and without backlogs to be eligible for award of minor degree. Regular and additional subjects shall be considered for SGPA calculation. If a student does not get a minimum SGPA of 8.0 or fails in any subject during fourth to seventh semesters, she/he will lose candidature for minor degree.

13.6 Degree will be issued under the seal of affiliating University.

14.0 Regulations for Lateral Entry Students under R20 UG

Title and application: These rules and regulations may be called R20UG-LE and come into force from academic year 2021-22 and exist in force until superseded by other regulations. These regulations are applicable to students admitted under lateral entry scheme leading to Bachelor's Degree in Technology (B.Tech).

a) *Regulations and curriculum*: The regulations and curriculum of R20UG shall be applicable in general with the following modifications:

   i. *Entry and duration*: The students will be admitted directly into third semester of regular 4-year B.Tech degree course governed by R20UG regulations. The duration of the course is three academic years.

   ii. *Curriculum*: Third semester to eighth semester curriculum of R20UG.

   iii. *Promotion by credits-earned requirement*: This is applicable for the promotion of a student from sixth semester to seventh semester only. She/he must earn at least 40% of total credits (rounded to lower integer) from third to fifth semesters for promotion from sixth semester to seventh semester.

b) Requirements for the award of B.Tech degree:

   i. Time limit for completion of requirements for award of degree is six academic years from the date of admission.

   ii. Registered and successfully completed all required credit-bearing and mandatory subjects with a total of 121 credits. (third semester to eighth semester subjects)

   iii. *Honours/minors designation*: shall earn extra 20 credits in addition to 121 credits.

15.0 Transitory Regulations

15.1 A student who initially joins the Institute in a previous Regulation and has to re- join in a semester of the present Regulations, due to any reason, shall be bound by the rules of the current Regulations. Board of Studies of the concerned Major will specify, extra or otherwise, academic coursework to be undertaken by such students who join the current Regulations.

KSRM COLLEGE OF ENGINEERING (AUTONOMOUS)

VISION & MISSION

VISION:

To evolve as center of repute for providing quality academic programs amalgamated with creative learning and research excellence to produce graduates with leadership qualities, ethical and human values to serve the nation.

MISSION:

M1: To provide high quality education with enriched curriculum blended with impactful teaching-learning practices.

M2: To promote research, entrepreneurship and innovation through industry collaborations.

M3: To produce highly competent professional leaders for contributing to Socio-economic development of region and the nation.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION & MISSION

VISION:

To emerge as globally recognized department in the frontier areas of Electronics and Communication Engineering

MISSION:

M1: To imbibe experiential, lifelong learning skills and problem solving capabilities through enriched curriculum and innovative teaching learning practices.

M2: To promote quality research by strengthening industry collaborations.

M3: To inculcate entrepreneurial attitude, leadership skills, human values and professional ethics..

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1: To apply the concepts of electronics, communication and computation and pursue career in core and allied industries to solve industrial and societal problems.

PEO2: To pursue higher education to progress professionally in contemporary Technologies and multidisciplinary fields with an inclination towards continuous learning.

PEO3: To exhibit professional skills, ethical values, interpersonal skills, leadership abilities, team spirit and lifelong learning.

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Program Outcomes:

PO1 - Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 - Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substaniated conclusions using first principles of mathematics, natural sicences, and engineering sciences.

PO3 - Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 - Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and sysnthesis of the information to provide valid conclusions.

PO5 - Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including predicition and modeling to complex engineering activities with an understanding of rhe limitations.

PO6 - The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 - Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 - Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO9 - Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 - Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions .

PO11 - Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projets and in multidisciplinary environemnts.

PO12 - Life-long learning: Reconize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

The Program Outcomes after successful completion of B.Tech ECE program are,

PSO1: An ability to design electronic circuits for applications including signal processing, communications, computer networks, Embedded systems and in the field of VLSI.

PSO2: Develop innovative technologies for Entrepreneurship with new cutting edge Technologies in the fields of electronic design, communication and automation.

PSO3: Identify and Apply Domain specific tools for Design, Analysis and Synthesis in the areas of Signal Processing, Communications, VLSI and Embedded systems.

ELECTRONICS AND COMMUNICATION ENGINEERING

Course Structure

I Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2021101	Linear Algebra and Calculus	BSC	3	0	0	40	60	3
2	20AP102	Applied Physics	BSC	3	0	0	40	60	3
3	2024103	Communicative English	HSC	3	0	0	40	60	3
4	2002104	Fundamentals of Electrical Engineering	ESC	3	0	0	40	60	3
5	2003105	Engineering Drawing	ESC	1	0	2	40	60	2
6	2003106	Engineering Drawing Lab	ESC	0	0	2	40	60	1
7	20AP107	Applied Physics Lab	BSC	0	0	3	40	60	1.5
8	2024108	Communicative English Lab	HSC	0	0	3	40	60	1.5
9	2002109	Fundamentals of Electrical Engineering Lab	ESC	0	0	3	40	60	1.5
Total				**13**	**0**	**13**	**360**	**540**	**19.5**

L - Lecture, T - Tutorial, P – Practical

II Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2021201	Differential Equations and Vector Calculus	BSC	3	0	0	40	60	3
2	2023202	Chemistry	BSC	3	0	0	40	60	3
3	2005203	C-Programming & Data Structures	ESC	3	0	0	40	60	3
4	2004204	Electronic Devices & Circuits	ESC	3	0	0	40	60	3
5	20EW205	Engineering Workshop	ESC	0	0	3	40	60	1.5
6	2005206	IT Workshop	ESC	0	0	3	40	60	1.5
7	2023207	Chemistry Lab	BSC	0	0	3	40	60	1.5
8	2005208	C-Programming & Data Structures Lab	ESC	0	0	3	40	60	1.5
9	2004209	Electronic Devices & Circuits Lab	ESC	0	0	3	40	60	1.5
10	20MC210	Environmental Science	MC	3	0	0	40	0	0.0
Total				**15**	**0**	**15**	**400**	**540**	**19.5**

III Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2021301	Special Functions and Complex Analysis	BSC	3	0	0	40	60	3
2	2004301	Signals and Systems	PCC	3	0	0	40	60	3
3	2004302	Digital System Design	PCC	3	0	0	40	60	3
4	2004303	Analog Circuits	PCC	3	0	0	40	60	3
5	2004304	Network Theory	PCC	3	0	0	40	60	3
6	2004305	Simulation Lab	PCC	0	0	3	40	60	1.5
7	2004306	Digital System Design Lab	PCC	0	0	3	40	60	1.5
8	2004307	Analog Circuits Lab	PCC	0	0	3	40	60	1.5
9	20SC308	Python Programming **(Skilled Course - I)**	SC	1	0	2	40	60	2
10	20MC309	Universal Human Values	MC	3	0	0	40	60	3
Total				**19**	**0**	**11**	**400**	**600**	**21.5**

IV Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2025401	Business Economics and Accounting for Engineers	HSC	3	0	0	40	60	3
2	2021403	Probability Theory & Stochastic Processes	PCC	3	0	0	40	60	3
3	2004403	Microprocessors and Microcontrollers	PCC	3	0	0	40	60	3
4	2004404	Electro Magnetic Waves and Transmission Lines	PCC	3	0	0	40	60	3
5	2004405	Linear and Digital IC Applications	PCC	3	0	0	40	60	3
6	2004406	Linear and Digital IC Applications Lab	PCC	0	0	3	40	60	1.5
7	2004407	Microprocessors and Microcontrollers Lab	PCC	0	0	3	40	60	1.5
8	2004408	LabView Programming Lab	PCC	0	0	3	40	60	1.5
9	20SC409	PCB Design **(Skilled Course –II)**	SC	1	0	2	40	60	2
Total				**16**	**0**	**11**	**360**	**540**	**21.5**
Community Service Project(Mandatory) For 6 Weeks Duration During Summer Vacation									

V Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2004501	Embedded systems and IoT	ESC	3	0	0	40	60	3
2	2004502	Communication Systems	PCC	3	0	0	40	60	3
3	2004503	Antennas and Wave Propagation	PCC	3	0	0	40	60	3
		Professional Elective Course-I							
4	2004504	Electronic Measurements and Instrumentation	PEC-I	3	0	0	40	60	3
	2004505	Computer Architecture and Organization							
	2004506	Optical Communication							
5		**Open Elective-1**							
		Courses offered by: **Civil engineering**							
	20CE101	Disaster management	OEC-1	3	0	0	40	60	3
	20CE102	Basics of Civil Engineering	OEC-1	3	0	0	40	60	3
	20CE103	Building Materials	OEC-1	3	0	0	40	60	3
		Courses offered by: **Mechanical Engineering**							
	20OE301	Introduction to Hybrid and Electric Vehicles	OEC-1	3	0	0	40	60	3
	20OE302	Rapid Prototyping	OEC-1	3	0	0	40	60	3
	20OE303	Design for Manufacturing and Assembly	OEC-1	3	0	0	40	60	3
	20OE304	Energy Systems Engineering	OEC-1	3	0	0	40	60	3
	20OE305	Smart Materials	OEC-1	3	0	0	40	60	3
		Courses offered by: **Electrical and Electronics Engineering**							
	20OE201	Modern Control Theory	OEC-1	3	0	0	40	60	3
	20OE202	Programming Fundamentals for Numerical Computations	OEC-1	3	0	0	40	60	3
		Courses offered by: **Computer Science and Engineering**							
	20OE501	Data Structures	OEC-1	3	0	0	40	60	3
	20OE502	Database Management Systems	OEC-1	3	0	0	40	60	3
		Courses offered by: **Artificial Intelligence and Machine Learning**							
	20OE3901	Data Structures	OEC-1	3	0	0	40	60	03
	20OE3902	OOP through C++	OEC-1	3	0	0	40	60	03
		Courses offered by: **Humanities and Sciences**							
	20OE601	Employability Skills	OEC-1	3	0	0	40	60	03
	20OE602	Advanced Numerical Methods	OEC-1	3	0	0	40	60	03
	20OE604	Basics of Nanotechnology	OEC-1	3	0	0	40	60	03
	20OE605	Write it Right	OEC-1	3	0	0	40	60	03
	20OE606	Human Capital Management	OEC-1	3	0	0	40	60	03

	20OE607	Engineering Materials	OEC-1	3	0	0	40	60	03
6	2004507	Communication Systems Lab	PCC	0	0	3	40	60	1.5
7	2004508	Embedded systems and IoT lab	ESC	0	0	3	40	60	1.5
8	20SC509	Introduction to Machine learning using Python **(Skill oriented course – III)**	SC	1	0	2	40	60	2
9	20MC510	Management Organizational behavior	MC	3	0	0	40	-	0
10	2004510	Community Service Project	PR	-	-	-	100	-	1.5
		Total		**19**	**0**	**10**	**460**	**480**	**21.5**

VI Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2004601	Digital Signal Processing	PCC	3	0	0	40	60	3
2	2004602	Microwave Engineering	PCC	3	0	0	40	60	3
3	2004603	Control Systems	PCC	3	0	0	40	60	3
		Professional Elective Course-II							
4	2004604	CMOS VLSI Design	PEC-II	3	0	0	40	60	3
	2004605	Information Theory & Coding							
	2004606	Sensors and Actuators							
		Humanities Elective							
5	2006601	Human Resource Development	HSC	3	0	0	40	60	3
	2006602	Digital Marketing							
	2006603	Project Management							
6	2004607	Digital Signal Processing Lab	PCC	0	0	3	40	60	1.5
7	2004608	Microwave & Optical Communication Lab	PCC	0	0	3	40	60	1.5
8	2004609	VLSI Design Laboratory	PCC	0	0	3	40	60	1.5
9	20SC610	Advanced English Communication lab (**Skill Oriented Course – I**V)	SC	1	0	2	40	60	2
10	20MC609	Constitution of India	MC	2	0	0	40	-	0
		Total		**18**	**0**	**11**	**400**	**540**	**21.5**
Industry Internship (Mandatory) for 6 - 8 Weeks Duration During Summer									

VII Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
		Professional Elective Course-III							
1	2004701	Nano Electronics	PEC-III	3	0	0	40	60	3
	2004702	Digital Image and Video Processing							
	2004703	Micro Electro-Mechanical Systems							
		Professional Elective Course-IV							
2	2004704	Wireless Communication	PEC-IV	3	0	0	40	60	3
	2004705	DSP Processors and Architectures							
	2004706	RF System Design							
		Professional Elective Course-V							
3	2004707	Low Power VLSI	PEC-V	3	0	0	40	60	3
	2004708	Biomedical Instrumentation							
	2004709	RADAR and Satellite Communication							
4		**Open Elective-2**							
		Courses offered by: **Civil Engineering**							
	20CE104	Solid Waste Management	OEC-2	3	0	0	40	60	3
	20CE105	Estimation and Costing	OEC-2	3	0	0	40	60	3
	20CE106	Water management	OEC-2	3	0	0	40	60	3
		Courses offered by: **Mechanical Engineering**							
	20OE306	Automotive Electronics, Sensors & Drives	OEC-2	3	0	0	40	60	3
	20OE307	Robotics and Applications in Manufacturing	OEC-2	3	0	0	40	60	3
	20OE308	Sensors in Intelligent Manufacturing	OEC-2	3	0	0	40	60	3
	20OE309	Non-Conventional Sources of Energy	OEC-2	3	0	0	40	60	3
	20OE310	Supply Chain Management	OEC-2	3	0	0	40	60	3
		Courses offered by: **Electrical and Electronics Engineering**							
	20OE203	Energy Conversion Systems	OEC-2	3	0	0	40	60	3
	20OE204	Smart grid	OEC-2	3	0	0	40	60	3
		Courses offered by: **Computer Science and Engineering**							
	20OE503	Java Programming	OEC-2	3	0	0	40	60	3
	20OE504	Web Designing	OEC-2	3	0	0	40	60	3
		Courses offered by: **Artificial Intelligence and Machine Learning**							
	20OE3903	Operating Systems	OEC	3	0	0	40	60	03

	20OE3904	Data Base Management Systems	OEC	3	0	0	40	60	03
	Courses offered by: **Humanities and Sciences**									
	20OE603	Mathematical Statistics for Data Science and Data Analytics	OEC	3	0	0	40	60	03
	20OE608	Basics of Electrical, Magnetic and Optoelectronic materials	OEC	3	0	0	40	60	03
	20OE609	Corrosion & Control	OEC	3	0	0	40	60	03
	20OE615	Academic Writing	OEC	3	0	0	40	60	03
	20OE611	Basics Financial Management for Engineers	OEC	3	0	0	40	60	03
5	**Open Elective-3**									
	Courses offered by: **Civil Engineering**									
	20CE107	Repair and rehabilitation of structures	OEC-3	3	0	0	40	60	3
	20CE108	Geo-environmental engineering	OEC-3	3	0	0	40	60	3
	20CE109	Environmental impact assessment	OEC-3	3	0	0	40	60	3
	Courses offered by: **Mechanical Engineering**									
	20OE311	Entrepreneurship	OEC-3	3	0	0	40	60	3
	20OE312	Solar Energy Systems	OEC-3	3	0	0	40	60	3
	20OE313	Internal Combustion Engine	OEC-3	3	0	0	40	60	3
	Courses offered by: **Electrical and Electronics Engineering**									
	20OE205	Intelligent Control Techniques	OEC-3	3	0	0	40	60	3
	20OE206	Electrical System Estimation & Costing	OEC-3	3	0	0	40	60	3
	Courses offered by: **Computer Science and Engineering**									
	20OE505	Operating System	OEC-3	3	0	0	40	60	3
	20OE506	R Programming	OEC-3	3	0	0	40	60	3
	Courses offered by: **Artificial Intelligence and Machine Learning**									
	20OE3905	Cyber Security	OEC-3	3	0	0	40	60	03
	20OE3906	Java Programming	OEC-3	3	0	0	40	60	03
	Courses offered by: **Humanities and Sciences**									
	20OE612	Transforms and Its Applications	OEC-3	3	0	0	40	60	3
	20OE613	Physics of Renewable Energy	OEC-3	3	0	0	40	60	3
	20OE614	Fuel Technology	OEC-3	3	0	0	40	60	3
	20OE615	Professional Communication	OEC-3	3	0	0	40	60	3
	20OE616	Digital and Social Media Management	OEC-3	3	0	0	40	60	3

6	**Open Elective -4**								
	Courses offered by: **Civil Engineering**								
	20OE110	Industrial safety engineering	OEC-4	3	0	0	40	60	3
	20OE111	Surveying	OEC-4	3	0	0	40	60	3
	20OE112	Traffic Engineering	OEC-4	3	0	0	40	60	3
	Courses offered by: **Mechanical Engineering**								
	20OE314	Energy Auditing	OEC-4	3	0	0	40	60	3
	20OE315	Sustainable Engineering	OEC-4	3	0	0	40	60	3
	20OE316	Industrial Engineering & Management	OEC-4	3	0	0	40	60	3
	Courses offered by: **Electrical and Electronics Engineering**								
	20OE207	Basic Power Electronics	OEC-4	3	0	0	40	60	3
	20OE208	System Reliability Concepts	OEC-4	3	0	0	40	60	3
	Courses offered by: **Computer Science and Engineering**								
	20OE508	Python Programming	OEC-4	3	0	0	40	60	3
	20OE509	Cloud Computing	OEC-4	3	0	0	40	60	3
	Courses offered by: **Artificial Intelligence and Machine Learning**								
	20OE3907	Data Analytics with Python	OEC-4	3	0	0	40	60	3
	20OE3908	Web Designing using PHP	OEC-4	3	0	0	40	60	3
	Courses offered by: **Humanities and Sciences**								
	20OE617	Operations Research	OEC-4	3	0	0	40	60	3
	20OE618	Fundamentals of Quantum Computation and Nano photonics	OEC-4	3	0	0	40	60	3
	20OE619	Green Chemistry & Technology	OEC-4	3	0	0	40	60	3
	20OE620	Creative Writing	OEC-4	3	0	0	40	60	3
	20OE621	Materials Management	OEC-4	3	0	0	40	60	3
7	20MC713	Mobile Application Development (**Skill Oriented Course – V**)	SC	1	0	2	40	60	2
8	2004714	Evaluation of Industry Internship	PR	-	-	-	100		3
		Total		**19**	**0**	**2**	**380**	**420**	**23**

VIII Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2004801	Project Work/Internship	PR	-	-	-	40	60	12
		Total		**-**	**-**	**-**	**40**	**60**	**12**

B.Tech I SEM ECE (R20)

<table>
<tr><td>Course Title</td><td colspan="5">Linear Algebra & Calculus</td><td colspan="3">B. Tech. I Sem
(Common to All Branches)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2021101</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Develop the use of matrix algebra techniques that is needed by engineers for practical applications.
CO 2	Utilize mean value theorems to real life problems.
CO 3	Classify **t**he functions of several variables which is useful in optimization techniques.
CO 4	Evaluate multiple integrals.
CO 5	Define Beta and Gamma functions.

Bridge Course: Limits, continuity, Types of matrices

UNIT- I

Matrices: (12 Hours)

Rank of a matrix by Echelon form, Normal form. Solving system of homogeneous and non- homogeneous linear equations. Eigen values and Eigen vectors for real matrices – Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley–Hamilton theorem. Diagonalization by orthogonal transformation.

UNIT-II

Mean Value Theorems: (08 Hours)

Rolle‟s theorem, Lagrange‟s mean value theorem, Cauchy‟s mean value theorem, Taylor‟s and Maclaurin‟s theorems with remainders (without proof), related problems.

UNIT-III

Multivariable Calculus: (10 Hours)

Partial derivatives, total derivative, chain rule, change of variables, Jacobians, Maxima andminima of functions of two variables – Lagrange"s method of undetermined multipliers.

UNIT-IV

Multiple Integrals: **(10 Hours)**

Evaluation of double integrals in Cartesian coordinates and polar coordinates – Change of variables in double integrals – Change the order of integration in double integrals – Evaluation of triple integrals in Cartesian and polar coordinates – Change of variables between cartesian, cylindrical and spherical polar coordinates.

UNIT- V

Beta and Gamma functions: **(08 Hours)**

Beta and Gamma functions and their properties, relation between Beta and Gamma functions,evaluation of definite integrals using Beta and Gamma functions.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-43 edition 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9^{th} edition-2013.

Reference Books:

1. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt.Ltd, New Delhi, 11^{th} Edition, Reprint 2010.
2. Linear Algebra: A Modern Introduction, D Poole, 2^{nd} Edition, Brooks/Cole, 2005.
3. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, LakshmiPublications, Reprint 2008

Course Title	Applied Physics					B. Tech ECE I Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20AP102	**BSC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 2Hrs						**End Exam Duration: 3Hrs**		

Course Objectives:

- To make a bridge between the physics in school and engineering courses.
- To identify the importance of the optical phenomenon i.e. interference, diffraction related to its Engineering applications.
- To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To enlighten the concepts of Quantum Mechanics and to provide fundamentals of de-Broglie waves, quantum mechanical wave equation and its applications, the importance of free electron theory and band theory of solids.
- Evolution of band theory to distinguish materials, basic concepts and transport phenomenon of charge carriers in semiconductors. To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define the different realms of physics and their applications in both scientific and technological systems through physical optics.
CO 2	Identify the wave properties of light and the interaction of energy with the matter.
CO 3	Illustrate the response of magnetic materials to the applied electric and magnetic fields.
CO 4	Explain the quantum mechanical picture of subatomic world along with the discrepancies between the classical estimates and laboratory observations of electrontransportation phenomena by free electron theory and band theory.
CO 5	Apply the physical properties exhibited by materials through the understanding of properties of semiconductors and superconductors.

UNIT-I

Wave Optics **10hrs**

Interference- Principle of superposition – Interference of light – Conditions for sustained interference - Interference in thin films (Reflection Geometry) – Colors in thin films – Newton‟s Rings – Determination of wavelength and refractive index.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit and N-slits (qualitative) – Grating spectrum.

UNIT-II

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein‟s coefficients – Population inversion – Lasing action – Pumping mechanisms-Nd-YAG laser – He-Ne laser – Semiconductor diode laser- Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture- Classification of optical fibers based on refractive index profile and modes – Block diagram ofOptical fiber Communication system – Propagation Losses (qualitative) – Applications.

UNIT- III

Dielectric and Magnetic Materials

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction to magnetic materials (Origin of magnetic moment of an atom and Classification of magnetic materials) –Weiss theory of ferromagnetism-soft ferrites and hard ferrites- Hysteresis – Soft and Hard magnetic materials- Applications magnetic materials.

UNIT-IV

Quantum Mechanics, Free Electron Theory

Quantum Mechanics- Dual nature of matter – Schrodinger‟s time independent and dependent wave equation – Significance of wave function – Particle in a one-dimensional infinite potential well.

Free Electron Theory- Classical free electron theory (Merits and demerits only) – Quantum freeelectron theory – Equation for electrical conductivity based on quantum free electron theory – Fermi-Dirac distribution – Density of states – Fermi energy.

UNIT-V

Semiconductors and Superconductors

Semiconductors- Introduction – Intrinsic semiconductors – Electrical conductivity – Fermi level- Extrinsic semiconductors –Dependence of Fermi energy on carrier concentration and temperature – Drift and diffusion currents – Einstein‟s equation – Direct and indirect band gap semiconductors – Hall effect – Hall coefficient – Applications of Hall effect.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) –High T_c superconductors – Applications of superconductors.

Text books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics – B.K. Pandey and S. Chaturvedi, Cengage Learning.

Reference Books:

1. Engineering Physics – Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
4. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill

Course Title	Communicative English					B. Tech ECE I Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2024103	**HSC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers To be able to solve problems related to diode circuits, and amplifier circuits.
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information.
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English.
CO 2	Apply grammatical structures to formulate sentences and correct word forms.
CO 3	Analyze discourse markers to speak clearly on a specific topic in informal discussions.
CO 4	Evaluate reading/listening texts and to write summaries based on global comprehensionof these texts.
CO 5	Create a coherent paragraph interpreting a figure/graph/chart/table.

UNIT- I

Lesson: On the Conduct of Life: William Hazlitt

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Writing :**Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary: Parts of Speech; Word formation, synonyms and antonyms; Idioms and Phrases; phrasal verbs.

UNIT- II

Lesson: The Brook: Alfred Tennyson

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Grammar and Vocabulary: Sentence structure; articles; Tenses; Prepositions.

UNIT-III

Lesson: A City Night Peace - Oliver Goldsmith

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific contextclues; strategies to use text clues for comprehension.

Writing: Summarizing, Paragraph Writing **Grammar and Vocabulary:** Voice; Reported Speech; Degrees of Comparison, Subject with agreement.

UNIT-IV

Lesson: Being Rich, Being Good - Chetan Bhagat

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters/Report Writing

Grammar and Vocabulary: Information Transfer; Simple, Compound and Complex sentences; Question Tags

UNIT- V

Lesson: Politics and the English Language: George Orwell

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides.

Reading: Reading for comprehension.

Writing: Writingstructured essays on specific topics using suitable claims and evidences.

Grammar and Vocabulary: Reading Comprehension; Dialogue Writing; Common Errors.

Prescribed Text:

1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge,2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. HeinleyELT; 2nd Edition, 2018.
3. Raymond Murphy‟s English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building aSuperior Vocabulary (2014)
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by DavidButler

Web links

www.englishclub.com

www.easyworldofenglish.com

www.languageguide.org/english/

www.bbc.co.uk/learningenglish

www.eslpod.com/index.html

www.myenglishpages.com

<table>
<tr><td>Course Title</td><td colspan="5">Fundamentals of Electrical Engineering</td><td colspan="3">B. Tech ECE I Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2002104</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to determine active, reactive, apparent power for single phase and three phase AC circuits, Principle and operation of transformers and performance characteristics of DC and AC machines, verification of Kirchhoff‟s laws andnetwork theorems for DC and AC excitation.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be ableto,</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the basic fundamentals of DC & AC circuits, network reduction techniques, network theorems, principle of DC and AC machines.</td></tr>
<tr><td>CO 2</td><td colspan="8">Determine the currents, voltages using mesh and nodal analysis, Average and RMSvalues for different waveforms.</td></tr>
<tr><td>CO 3</td><td colspan="8">Evaluate the active and reactive powers, voltage and currents for balanced and unbalanced networks.</td></tr>
<tr><td>CO 4</td><td colspan="8">Obtain the EMF equation and characteristics of dc machines, Induction motor and synchronous machine.</td></tr>
<tr><td>CO 5</td><td colspan="8">Evaluate the equivalent circuit and to calculate losses of single phase transformer.</td></tr>
</table>

UNIT- I

DC Circuits: Ohm's Law and Kirchhoff‟s Laws, Analysis of series, parallel and series-parallel circuits excited by independent voltage sources; Power and energy; simple numerical problems. Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields, simple numerical problems.

UNIT- II

AC Circuits: Definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L,C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, simple numerical problems.

Three Phase Systems: Definition of Phase sequence, balanced supply and balanced load, Relationship between line and phase values of balanced star and delta connections, Power in balanced three phase circuits, simple numerical problems.

UNIT-III

Network Theorems: Superposition and Reciprocity Theorems, Thevenin‟s, Norton‟s, Maximum Power Transfer, Millman‟s Theorems, Compensation Theorem.

Transformers: Principle of operation and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation, OC and SC Tests.

UNIT-IV

DC Generators: Constructional Features, E.M.F Equation, Types of Generators, OCC, Internal & External Characteristics of Generators, Applications.

D.C Motors: Back E.M.F, Torque Equation, Characteristics and Applications, Speed Control (Shunt Motor)– field and armature. Three Point Starter, Losses, Calculation of Efficiency,Swinburne‟s Test.

UNIT- V

Three phase Induction motor: Revolving magnetic field theory, Principle of operation, Torque equation, and Torque –speed characteristics.

Three phase Synchronous Machines: Principle and Constructional Features of Salient Pole and Round Rotor Machines, E.M.F Equation, Voltage Regulation by Synchronous Impedance Method, Theory of Operation of Synchronous Motor.

Text Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

Reference Books:

1. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
4. V.K. Mehta, Rohit Mehta, "Principles of Electrical Engineering",S.Chand, 2005.
5. http://www.nptelvideos.in/2012/11/basic-electrical-technology.html

<table>
<tr><td>Course Title</td><td colspan="4">Engineering Drawing</td><td colspan="3">B. Tech ECE I Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2003105</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>1</td><td>0</td><td>2</td><td>2</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Draw various curves applied in engineering..
CO 2	Show projections of solids and sections graphically.
CO 3	Draw the development of surfaces of solids.
CO 4	Know draw orthographic and isometric projections
CO 5	Evaluate different methods of perspective view.

UNIT-I

Introduction to Engineering Drawing: Principles of Engineering Drawing and itsSignificance-Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only

b) Cycloid, epicycloids and hypocycloid c) Involutes

UNIT-II

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

Projections of solids: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

UNIT-III

Sections of solids: Section planes and sectional view of right regular solids- prism,cylinder, pyramid and cone. True shapes of the sections.

Development of surfaces: Development of surfaces of right regular solids-prism,cylinder, pyramid, cone and their sectional parts.

UNIT-IV

Orthographic Projections: Systems of projections, conventions and application toorthographic projections - simple objects.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometricviews: lines, planes, simple solids.

UNIT-V

Perspective projection –applications of perspective view –terminology ofperspective view- methods of drawing perspective view-simple problems.

Text Books:

1. K L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, Scitech Publishers,Chennai, 2012.
2. N. D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers,2016.

Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right,2009
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers,2000
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education,2009
4. K.C.John, Engineering Graphics, 2/e, PHI,2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill,Copy Right, 2008.

Additional Sources:

1. Youtube: http-sewor, Carleton. cag,kardos/88403/drawings.html conic sections-online, red woods.edu

<table>
<tr><td>Course Title</td><td colspan="4">Engineering Drawing Lab</td><td colspan="3">B. Tech ECE I Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2003106</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6"></td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• Familiarize how industry communicates technical information.
• Teach the practices for accuracy and clarity in presenting the technical information.
• Develop the engineering imagination essential for successful design.
• Bring awareness that Engineering Drawing is the Language of Engineers.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Use computers as a drafting tool.</td></tr>
<tr><td>CO 2</td><td colspan="8">Draw isometric drawings using CAD packages.</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze orthographic drawings using CAD packages.</td></tr>
</table>

- Instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3Dmodeling.
- Instruct graphical representation of machine components.

Computer Aided Drafting:

Introduction to AutoCAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets,arrays,dimensions. Dimensioning principles and conventional representations.

Orthographic Projections: Systems of projections, conventions and application toorthographic projections - simple objects.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometricviews: lines, planes, simple solids.

Text Books:

1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New AgeInternational Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with AutoCad, PHI Learning, Eastern Economy editions.

Reference Books:

1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers,Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
4. K.C.John, Engineering Graphics, 2/e, PHI,2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill,Copy Right, 2008.

Additional Sources

1. Youtube: http-sewor,Carleton.cag, kardos/88403/drawings.html conic sections-online, red woods.edu

<table>
<tr><td>Course Title</td><td colspan="5">Applied Physics Lab</td><td colspan="3">B. Tech ECE I Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20AP107</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
- Illustrates the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Operate various optical instruments.
CO 2	Estimate wavelength of laser and particles size using laser and the susceptibility and related magnetic parameters of magnetic materials.
CO 3	Evaluate the acceptance angle of an optical fiber and numerical aperture
CO 4	plot the intensity of the magnetic field of circular coil carrying current with distance
CO 5	Determine magnetic susceptibility of the material and its losses by B-H curve (L3) apply the concepts of ultrasonics by acoustic grating.

Note: In the following list, out of 12 experiments, any 10 experiments (minimum 8) must be performed in a semester

<u>List of Applied Physics Experiments</u>

1. Determine the thickness of the wire using wedge shape method

Experimental outcomes:

Operates optical instrument like travelling microscope. (L2)

Estimate the thickness of the wire using wedge shape method (L2)

Identifies the formation of interference fringes due to reflected light from non-uniform thin film. (L2)

2. Determination of the radius of curvature of the lens by Newton‟s ring method

Experimental outcomes:

Operates optical instrument like travelling microscope. (L2)

Estimate the radius of curvature of the lens (L2)

Identifies the formation of interference fringes due to reflected light from non-uniform thin film. (L2)

Plots the square of the diameter of a ring with no. of rings (L3)

3. Determination of wavelength by plane diffraction grating method

Experimental outcomes:

Operates optical instrument like spectrometer. (L2)

Estimate the wavelength of the given source (L2)

Identifies the formation of grating spectrum due diffraction. (L2)

4. Determination of dispersive power of prism.

Experimental outcomes:

Operates optical instrument like spectrometer. (L2)

Estimate the refractive index and dispersive power of the given prism (L2)

Identifies the formation of spectrum due to dispersion. (L2)

5. Determination of wavelength of LASER light using diffraction grating.

Experimental outcomes:

Operates various instrument (L2)

Estimate the wavelength of laser source (L2)

Identifies the formation of grating spectrum due diffraction. (L2)

6. Determination of particle size using LASER.

Experimental outcomes:

Operates various instrument (L2) **Estimate** the Particles size using laser (L2)**Identifies** the application of laser (L2)

7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)

Estimate the numerical aperture and acceptance angle of a given optical fiber. (L2)

Identifies the significance of numerical aperture and acceptance angle of an optical fiber in various engineering applications. (L2)

8. Determination of dielectric constant by charging and discharging method.

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)

Estimate the dielectric constant of the given substance. (L2)

Identifies the significance of dielectric constant in various devices. (L2)

9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee‟smethod.

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)

Estimate the magnetic field along the axis of a circular coil carrying current. (L2)

Plots the intensity of the magnetic field of circular coil carrying current with distance(L3)

10. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)

Estimate the hysteresis loss, coactivity and retentivity of the ferromagnetic material.(L2)

Classifies the soft and hard magnetic material based on B-H curve. (L2)

Plots the magnetic field H and flux density B (L3)

11. To determine the resistivity of semiconductor by Four probe method

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)

Estimate the resistivity of a semiconductor. (L2)

Identifies the importance of four probe method in finding the resistivity ofsemiconductor. (L3)

12. To determine the energy gap of a semiconductor

Experimental outcomes:

Operates various instruments and connect them as per the circuit. (L2)

Estimate the energy gap of a semiconductor. (L2) **Illustrates** the engineering applications of energy gap. (L3)**Plots 1/T** with log R (L3)

<table>
<tr><th>Course Title</th><th colspan="5">Communicative English Lab</th><th colspan="3">B. Tech ECE I Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">2024108</td><td rowspan="2">HSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6"></td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• Students will be exposed to a variety of self instructional, learner friendly modes of language learning.
• Students will learn better pronunciation through stress, intonation and rhythm.
• Students will be trained to use language effectively to face interviews, group discussions, public speaking.
• Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc.</td></tr>
</table>

<table>
<tr><td colspan="2">Course Outcomes: On successful completion of this course, the students will be ableto</td></tr>
<tr><td>CO 1</td><td>Listen and repeat the sounds of English Language.</td></tr>
<tr><td>CO 2</td><td>Understand the different aspects of the English language proficiency with emphasis on LSRW skills.</td></tr>
<tr><td>CO 3</td><td>Apply communication skills through various language learning activities</td></tr>
<tr><td>CO 4</td><td>Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.</td></tr>
<tr><td>CO 5</td><td>Evaluate and exhibit acceptable etiquette essential in social and professional.</td></tr>
<tr><td>CO 6</td><td>Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.</td></tr>
</table>

UNIT-I

- Listening Skills
- Phonetics
- Introducing oneself

UNIT-II

- Describing objects
- JAM / Interpretation of Hypothetical Situations
- Role play

UNIT-III

- Hypothetical situations (If…were)
- Elocution
- TED talks videos

UNIT- IV

- Visual Description
- Situational conversations

UNIT-V

- Oral Presentations
- PowerPoint presentations

Suggested Software:

- Orell
- Walden Infotech
- Young India Films
- K-Van solutions

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. HeinleyELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Web Links

www.esl-lab.com

www.englishmedialab.com

www.englishinteractive.net

<table>
<tr><td>Course Title</td><td colspan="5">Fundamentals of Electrical Engineering Lab</td><td colspan="3">B. Tech ECE I Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2002109</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6"></td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to learn basics of DC and AC circuits, Electrical Machines, Transformers.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
</table>

CO 1	Understand the Kirchhoff‟s laws, network theorem theoretically and practically for any given circuit.
CO 2	Evaluate the characteristics and efficiency of Induction Motor.
CO 3	Determine the speed, torque and efficiency of electrical machines.
CO 4	Determine the regulation of alternator.
CO 5	Obtain the efficiency and regulation for single phase transformer

List of Experiments (Any 10 experiments 5 from each stream)

Electric Circuits:

1. Verification of Kirchhoff‟s laws
2. Verification of Superposition Theorem
3. Verification of Thevenin‟s Theorem
4. Verification of Norton‟s Theorems
5. Verification of Maximum Power Transfer Theorem
6. Verification of Compensation Theorem

Electrical Machines:

1. Magnetization characteristics of a separately excited DC generator
2. Load characteristics of DC shunt generator
3. Swinburne‟s test
4. Brake test on 3-phase Induction motor
5. OC & SC tests on a 1-ϕ transformer
6. Predetermination of regulation of alternator by Synchronous impedance method.

B.Tech II SEM ECE (R20)

<table>
<tr><td>Course Title</td><td colspan="5">Differential Equations and Vector Calculus</td><td colspan="3">B. Tech. II Sem
(Common to All Branches)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2021201</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Classify second and higher order liner differential equations with constant coefficients.
CO 2	Solve partial differential equations.
CO 3	Analyze the applications of partial differential equations.
CO 4	Understand vector differentiation concepts.

UNIT-I

Linear differential equations of higher order (constant coefficients) : (10 Hours) Definitions, homogeneous and non- homogeneous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters.

UNIT- II

Partial Differential Equations: (10 Hours)

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange‟s method.

UNIT-III

Applications of Partial Differential Equations: (10 Hours)

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation.

UNIT-IV

Vector differentiation: (08 Hours)

Scalar and vector point functions, vector operator del, del applies to scalar point functions- Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V

Vector integration: (08 Hours)

Line integral-circulation-work done, surface integral-flux, Green‟s theorem in the plane (without proof), Stoke‟s theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-43 edition2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9th edition-2013
3. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, Pearson, 9th Edition, Reprint, 2002.

Reference Books:

1. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt. Ltd, New Delhi, 11th Edition, Reprint 2010.
2. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, Lakshmi Publications, Reprint 2008.
3. Differential Equations and Vector Calculus, Dr. B.Rama Bhupal Reddy, G.Sreedhar, Dr. V.Ramachandra Reddy, Research India Publications, Delhi, 2020

Course Title	Chemistry					B. Tech ECE II Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2023202	BSC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To familiarize engineering chemistry and its applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods, molecular machines and switches.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Compare the materials of construction for battery and electrochemical sensors.
CO 2	Explain the preparation, properties, and applications of thermoplastics & thermosetting, Elastomers & conducting polymers.
CO 3	Understand the principles of spectrometry, slc in separation of solid and liquid mixtures.
CO 4	Explain the principles of spectrometry, slc in separation of solid and liquid mixtures
CO 5	Analyze the principles and different application of analytical instruments.

UNIT-I

Structure and Bonding Models: (10 hrs)

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, applications to hydrogen, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 , NO and CO, etc., calculation of bond order.

UNIT-II

Modern Engineering materials: (10 hrs)

i).Understanding of materials: Crystal field theory – salient features – splitting in octahedral, tetrahedral and square planar geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic properties and colour.

ii). Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures.

iii). Nanochemistry: Introduction, classification of nanometerials, properties and applications of Fullerenes, carbonnano tubes and Graphines nanoparticles.

UNIT-III

Electrochemistry and Applications: (10 hrs)

Introduction to Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode); Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, Potentiometry- Potentiometry titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations), pH metric concepts.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

UNIT-IV

Polymer Chemistry: (10 hrs)

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylenes,– mechanism of conduction and applications.

UNIT-V

Instrumental Methods and Applications (10 hrs)

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert‟s law. Regions of Electromagnetic radiation. UV-Visible**,** IR Spectroscopes‟- (selection rules, principles and applications). Solid-Liquid Chromatography–TLC, retardation factor.

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins‟ Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc GrawHill, 2020.
2. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
4. J.M.Lehn, Supra Molecular Chemistry, VCH Publications.

<table>
<tr><td>Course Title</td><td colspan="4">C Programming & Data Structures</td><td colspan="3">B. Tech ECE II Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2005203</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• The course aims to provide exposure to problem-solving through programming
• It aims to train the student to the basic concepts of the C programming language
• Gain knowledge of data structures and their applications</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Formulate simple algorithms for arithmetic and logical problems and to translate the algorithms to programs (in C Language).</td></tr>
<tr><td>CO 2</td><td colspan="8">Choose the loops and decision-making statements to solve the problem.</td></tr>
<tr><td>CO 3</td><td colspan="8">Implement different Operations on arrays.</td></tr>
<tr><td>CO 4</td><td colspan="8">Use functions to solve the given problem.</td></tr>
<tr><td>CO 5</td><td colspan="8">Understand structures, unions and pointers.</td></tr>
<tr><td>CO 6</td><td colspan="8">Understand need of data structures in real time situations.</td></tr>
</table>

UNIT-I

Introduction to C programming: - C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements. **Jumping statements:** break, continue and goto statements

UNIT-II

Arrays: Introduction, Declaration and initialization of 1D and 2D arrays, **Functions:** Introduction, Category of functions, parameter passing methods, Storage Classes, Recursive functions. **Strings:** String I/O functions, string handling functions, array of strings

UNIT-III

Pointers: Introduction to pointers, declaring and initialization of pointer variable, accessing the address of variables, accessing a variable through its pointer, chain of pointers. **Structures and unions:** Introduction, defining a structure, declaring structure variable, structure initialization, accessing members of structure, copying and comparing structure variables, structures within structures, array of structures, and introduction of union.

UNIT IV

Data Structures: Overview on data structures, stack, basic operations on stack, Applications of stacks; Queues -various classification of queues, basic operations on queues.

Searching and sorting: linear search, binary search, bubble sort, selection sort, insertion sort.

UNIT-V

Linked Lists – Single linked list, Operations on Single Linked List: insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

Trees - Tree terminology, representation, Binary trees, representation, binary tree traversals. Binary tree operations.

Text Books:

1. E. Balagurusamy, C Programming and Data structures,Fourth Edition, McGrawHill.
2. Rema Theraja, Programming in C, second edition,Oxford.
3. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
4. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.AnandaRao, Pearson Education

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall of India
2. R.G. Dromey, How to solve it by Computer,Pearson.
3. YashavantKanetkar, Let us C, 15^{th} edition, BPBPublications.
4. Dr. P. ChennaReddy, Computer Fundamentals and C Programming, SecondEdition.

<table>
<tr><td>Course Title</td><td colspan="5">Electronic Devices and Circuits</td><td colspan="3">B. Tech ECE II Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004204</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand principle of operation, characteristics and applications of Semiconductor diodes, Bipolar Junction Transistor and MOSFETs.
CO 2	Applying the basic principles solving the problems related to Semiconductor diodes, BJTs, and MOSFETs.
CO 3	Analyze diode circuits for different applications such as rectifiers, clippers and clampers also analyze biasing circuits of BJTs, and MOSFETs.
CO 4	Design of diode circuits and amplifiers using BJTs, and MOSFETs.
CO 5	Compare the performance of various semiconductor devices.

UNIT-I

Review of Semiconductors: Intrinsic semiconductors, Doped Semiconductors, Current Flow in Semiconductors, PN Junction with Open Circuit, PN Junction with Applied Voltage, Capacitive Effects in PN Junction.

Diodes: Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias, reverse bias, and breakdown regions, Modeling the Diode Forward Characteristics- exponential model, graphical analysis and Iterative analysis using the exponential model, constant voltage drop model, the small signal model.

UNIT-II

Zener Diodes– Zener diode Characteristics, Voltage shunt regulator, Temperature Effects, Rectifier Circuits– half-wave, full-wave and bridge rectifier circuits, rectifier with a filter capacitor, C-L-C filter, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottky barrier diode, Varactor diode, photo diode, light emitting diode(LED), Problem Solving.

Bipolar Junction Transistors(BJTs): Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, and saturation modes, V-I Characteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect.

UNIT-III

BJT circuits at DC, Applying the BJT in Amplifier Design- Voltage Amplifier, Voltage Transfer Characteristic (VTC), Small-Signal Voltage Gain, determining the VTC by Graphical Analysis, Q-point, Small-signal operation and models- the transconductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid-π Model, the T Model, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Biasing in BJT Amplifier Circuits- Fixed bias, Self bias, voltage divider bias circuits, biasing using a Constant-Current Source, CE amplifier – Small signal analysis and design, Transistor breakdown and Temperature Effects, Problem solving.

UNIT-IV

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET,CMOS, V-I characteristics–i_D - v_{DS} characteristics, i_D – v_{GS} characteristics, finite output resistance in saturation, characteristics of the p-Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point. Problem solving.

UNIT-V

MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations– three basic configurations, characterizing amplifiers, common source(CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response, Biasing in MOSFET Amplifier Circuits– biasing by fixing V_{GS} with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, Common Source Amplifier using MOSFETs – Small signal analysis and design, Body Effect, Problem Solving.

Text Books:

1. Adel S. Sedra and KennethC. Smith, "Microelectronic Circuits – Theory andApplications", 6th Edition, Oxford Press, 2013.
2. Donald A Neamen, "Electronic Circuits – analysis and design", 3rdEdition, McGraw Hill (India), 2019.

Reference Books:

1. J. Milliman and C Halkias, "Integrated electronics", 2nd Edition, Tata McGraw Hill,1991.
2. Behzad Razavi, "Microelectronics", Second edition, Wiley, 2013.
3. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits," 9th Edition,Pearson, 2006.
4. Jimmie J Cathey, "Electronic Devices and Circuits," Schaum"s outlines series, 3rdedition, McGraw-Hill (India), 2010.

<table>
<tr><td>Course Title</td><td colspan="5">Engineering Workshop</td><td colspan="3">B. Tech ECE II Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20EW205</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: To familiarize students with
▪ sheet metal operations,
▪ fitting ,
▪ electrical house wiring skills
▪ wood working</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Apply wood working skills in real world applications.</td></tr>
<tr><td>CO 2</td><td colspan="8">Build different objects with metal sheets in real world applications.</td></tr>
<tr><td>CO 3</td><td colspan="8">Apply fitting operations in various applications.</td></tr>
<tr><td>CO 4</td><td colspan="8">Apply different types of basic electric circuit connections.</td></tr>
<tr><td>CO5</td><td colspan="8">Use soldering and brazing techniques.</td></tr>
</table>

Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints Half – Lap joint Mortise and Ten on joint Corner Dovetail joint or Bridle joint

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Fitting:

Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Dovetail fit c) Semi-circular fit d) square fitting

Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two way switch c) Go down lighting d) Tube light

e) Three phase motor f) Soldering of wires

Note: In each section a minimum of three exercises are to be carried out.

<table>
<tr><th>Course Title</th><th colspan="5">IT Workshop</th><th colspan="3">B. Tech ECE II Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">2005206</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To make the students know about the internal parts of a computer, assembling and dissembling a computer from the parts, preparing a computer for use by installing the operating system.
- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations and LAteX.
- To learn about Networking of computers and use Internet facility for Browsing and Searching.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
CO 2	Prepare the Documents using Word processors and Prepare spread sheets for calculations .using excel and also the documents using LAteX.
CO 3	Prepare Slide presentations using the presentation tool.
CO 4	Interconnect two or more computers for information sharing.
CO 5	Access the Internet and Browse it to obtain the required information.

Preparing your Computer

Task 1:

Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2:

Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods.

Task 3:

Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot.Students should record the entire installation process.

Task 4:
Operating system features: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Networking and InternetTask 5:

Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc. should be done by the student. The entire process has to be documented.

Task 6:
Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.
They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating email account.

Task 7:
Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

Productivity toolsTask 8:
Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit auser manual of the word processor considered,
Image Manipulation tools.

Task 9:

Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

Task 10:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 11:

LateX: Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

References:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, PowerPoint & Outlook Exams, Joan Lambert, Joyce Cox,PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual.Addison-wesley; 1994.

Course Title	Chemistry Lab					B. Tech ECE II Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2023207	**BSC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End lab Exam**	**Total**
		0	**0**	**3**	**1.5**	**40**	**60**	**100**
					End Exam Duration: 3Hrs			

Course Objectives:

- To verify the fundamental concepts with experiments.

Course Outcomes: At the end of the course, the students will be able to

CO 1	Determine the cell constant and conductance of solutions.
CO 2	Synthesis of advanced polymer Bakelite.
CO 3	Calculate the strength of an acid present in secondary batteries.
CO 4	Illustrate the IR of some organic compounds
CO 5	Explain acid-base titrations using pH metry.

List of Experiments:

1. Conduct metric titration of strong acid vs. strong base.
2. Conduct metric titration of weak acid vs. strong base
3. pH metric titration of strong acid vs. strong base.
4. pH metric titration of weak acid vs. strong base
5. Determination of cell constant and conductance of solutions
6. Potentiometry - determination of redox potentials and emfs
7. Determination of Strength of an acid in Pb-Acid battery
8. Preparation of Bakelite.
9. Verify Lambert-Beer‟s law
10. Thin layer chromatography
11. Identification of simple organic compounds by IR.
12. Preparation of nanomaterial‟s by precipitation
13. Estimation of Ferrous Iron by Dichrometry.

<table>
<tr><th>Course Title</th><th colspan="4">C Programming & Data Structures Lab</th><th colspan="3">B. Tech ECE II Sem (R20)</th></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2005208</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- know how to write and debug programs
- know the principles of designing structured programs
- Write basic C programs using, Selection statements, Repetitive statements,
- Functions, Pointers, Arrays, Strings and structures
- To apply suitable data structure to solve real world problems

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Formulate the algorithms for simple problems.
CO 2	Translate given algorithms to a working and correct program.
CO 3	Correct syntax errors as reported by the compilers.
CO 4	Identify and correct logical errors encountered at runtime.
CO 5	Write iterative as well as recursive programs.
CO 6	Represent data in arrays, strings and structures and manipulate them through a program.
C O7	Write programs on data structures like stack, queue, liked list, trees etc.

1. Ramesh „s basic salary is input through the keyboard. His dearness allowance is 40% of basic salary and house rent allowance is 20% of basic salary. Write a C program to calculate his grosssalary.

2. Write a program to take input of name, roll no and marks obtained by a student in 5 subjects each have its 100 full marks and display the name, roll no with percentage score secured.

3. a) Write a C program to find out whether a given number is even number or odd number.
b) Write a C program to check whether a given year is leap year or not.

4. Design and develop an algorithm that takes three coefficients (***a***, ***b***, and ***c***) of aQuadratic equation ($\boldsymbol{a}x^2+\boldsymbol{b}x+\boldsymbol{c}=0$) as input and compute all possible roots. Implement a C program for the developed algorithm and execute the same to output the possible roots for a given set of coefficients with appropriatemessages.

5. If the ages of the Ramesh, Suresh and Mahesh are input through the keyboard, writea C program to determine youngest of the three.

6. A character is entered through keyboard. Write a C program to determine whetherthe character entered is a capital letter, a small case letter, a digit or a special symbol using if- else and switch case. The following table shows the range of ASCII values for various characters.

Characters	**ASCII values**
A–Z	65 – 90
a– z	97 – 122
0 – 9	48 – 57
Special symbols	0 – 47, 58 – 64, 91 – 96, 123 – 127.

7. Write a C program which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use switch statement).

8. Design and develop an algorithm to find whether a given number is Armstrong number or not. Implement a C program for the developed algorithm.

9. Design and develop an algorithm to check whether a given number is palindrome or not. Implement a C program for the same.

10. Write a C program to generate all the prime numbers between 1 and n, where n is avalue supplied by the user.

11. Write a C program to generate the first N terms of Fibonacci sequence.

12. Write a C program to find the smallest and largest number in a givenarray.

13. Write a C program to find the frequency of a particular number in a list ofintegers.

14. Write a C program to sort the list of elements using

a) Bubble Sort b) Selection sort.

15. Write a C program to search for an element in a list of elements using

a) Linear search b) Binary search

16. Write a C program to read two matrices and perform the following operations

a) Addition of two matrices

b) Multiplication of two matrices

17. Partitioning an array

Given a randomly ordered array of n elements, write a C program to partition the elements into two subsets such that elements ≤X are in one subset and elements ≥X are in another subset.

18. Write a C program to rearrange the elements in an array so that they appear in reverse order.

19. If a string and its reversed string are same then the string is called as palindrome string. Design and develop an algorithm to check whether a given string is a palindrome or not and implement a C program for the same.

20. Write a C program to read two strings and perform the following operations without using built string library functions.

i) String length ii) String reversing

iii) Comparison of two strings iv) Concatenation of two strings

21. Write a C program to count the number of vowels, consonants, digits, blank spaces and special characters in a given string.

22. Write a C program to swap the contents of two variables using

a) Call by value **b)** Call by reference.

23. Write a C program using recursion to

a) Find the factorial of a given number

b) Print the Fibonacci series up to a given number.

c) Find the GCD of two integers.

24. Write a C program to define a structure with the followingmembers.

Roll No., Name, marks in Sub1, Sub2, Sub3. Read the n students records and find the total marks of each student and print the result in the following format.

Roll No	Name	Sub1	Sub2	Sub3	Total marks	result
239Y1A0501	Siva	80	70	75	225	Distinction

25. Write C programs that implement stack (its operations) using

i) Arrays

ii) Pointers

26. Write C programs that implement Queue (its operations) using

i) Arrays

ii) Pointers

27. Write a C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression

ii) Evaluating the postfix expression.

28. Write a C program that uses functions to perform the following operations on singlelinked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

29. Write a C program that uses functions to perform the following operations on Doublelinked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

30. Write a C program that uses functions to perform the following:

i) Creating a Binary Tree of integers

ii) Traversing the above binary tree in preorder, inorder and postorder.

<u>Text Books:</u>

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
2. B.A.Forouzon and R.F. Gilberg, “COMPUTER SCIENCE: A Structured Programming Approach Using C”, Third edition, CENGAGE Learning, 2016.
3. Richard F. Gilberg& Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Second Edition, CENGAGE Learning, 2011
4. E. Balagurusamy, Programming in ANSI C, Fifth Edition, McGrawHill.

Course Title	Electronic Devices and Circuits Lab					B. Tech ECE II Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004209	ESC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs			

Course Objectives:

- To verify the theoretical concepts practically from all the experiments.
- To analyses the characteristics of Diodes, BJT, MOSFET, UJT.
- To design the amplifier circuits from the given specifications.
- To Model the electronic circuits using tools such as PSPICE/Multisim

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basic characteristics and applications of basic electronic devices.
CO 2	Observe the characteristics of electronic devices by plotting graphs.
CO 3	Analyze the Characteristics of UJT, BJT, MOSFET
CO 4	Design MOSFET / BJT based amplifiers for the given specifications.
CO 5	Simulate all circuits in PSPICE /Multisim.

LIST OF EXPERIMENTS: (**Execute any 12 experiments**).

Note: All the experiments shall be implemented using both Hardware and Software.

1. Verification of Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistances of the diode from the graphs obtained.
2. Design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. Draw suitable graphs.
3. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs.
4. Design a Zener diode-based ***voltage regulator*** against variations of supply and load. Verify the same from the experiment.
5. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find ***Threshold voltage*** (V_T), g_m, & K from the graphs.
6. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find I_{DSS}, g_m, & V_P from the graphs.
7. Verification of the input and output characteristics of BJT in **Common Emitter** configuration experimentally and find required ***h – parameters*** from the graphs.
8. Study and draw the input and output characteristics of BJT in **Common Base** configuration

experimentally, and determine required ***h – parameters*** from the graphs.

9. Study and draw the Volt Ampere characteristics of UJT and determine η, I_P, I_v, V_P, & V_v from the experiment.
10. Design and analysis of voltage- divider bias/self-bias circuit using BJT.
11. Design and analysis of voltage- divider bias/self-bias circuit using JFET.
12. Design and analysis of self-bias circuit using MOSFET.
13. Design a suitable circuit for switch using CMOSFET/JFET/BJT.
14. Design a small signal amplifier using MOSFET (common source) for the given specifications. Draw the frequency response and find the bandwidth.
15. Design a small signal amplifier using BJT(common emitter) for the given specifications. Draw the frequency response and find the bandwidth.

Tools / Equipment Required: Software Tool like Multisim/ Pspice or Equivalent, DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices

<table>
<tr><td>Course Title</td><td colspan="5">Environmental Science</td><td colspan="3">B. Tech ECE II Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20MC210</td><td rowspan="2">MC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>40</td><td>-</td><td>40</td></tr>
<tr><td colspan="6">Mid Exam Duration: 2Hrs</td><td colspan="3"></td></tr>
<tr><td colspan="9">Course Objectives:
• To make the students to get awareness on environment.
• To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life.
• To save earth from the inventions by the engineers.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Explain multidisciplinary nature of environmental studies and various Renewable and Nonrenewable resources.</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand Energy flow, bio-geo chemical cycles and ecological pyramids</td></tr>
<tr><td>CO 3</td><td colspan="8">Illustrate various causes of pollution and related preventive measures.</td></tr>
<tr><td>CO 4</td><td colspan="8">Summarize Solid waste management, Social issues related to environment and their protection acts.</td></tr>
<tr><td>CO 5</td><td colspan="8">Evaluate Causes of population explosion, value education and welfare programmes.</td></tr>
</table>

UNIT-I

Multidisciplinary Nature Of Environmental Studies: –Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems.

Forest resources: deforestation, case studies – Mining, dams and other effects on forest and tribal people

Water resources: Use and over utilization of surface and ground water conflicts over water.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Renewable &Non-Renewable.

UNIT-II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Food chains, food web-

Ecological succession and ecological pyramids – Introduction, types, characteristic features,structure and function of the following ecosystem:

a. Forest ecosystem.

b. Desert ecosystem

c. Aquatic ecosystems (lakes, rivers and oceans)

Biodiversity And Its Conservation : Introduction, Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.

b. Water pollution

c. Soil pollution

d. Marine pollution

e. Noise pollution

f. Thermal pollution

g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes- Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT-IV

Social Issues And The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents.

Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act.

UNIT-V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

B.Tech III SEM ECE (R20)

Course Title	Special Functions and Complex Analysis					B. Tech ECE III Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2021301	BSC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	-	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

The objective of this course is to familiarize the student's knowledge on Bessel functions, Legendre's polynomials. The concepts of complex variables to equip the students to solve application problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Discuss Bessel functions and Legendre's polynomials.
CO 2	Determine the differentiation of complex functions used in engineering problems and construction of analytic functions.
CO 3	Analyze images from z-plane to w-plane.
CO 4	Determine complex integration along the path.
CO 5	Apply Residue theorem to evaluate real definite integrals.

UNIT-I

Bessel functions –Introduction – Recurrence formulae for $J_n(x)$ – Generating function for $J_n(x)$ – Jacobi series – Orthogonality of Bessel functions – Legendre's equation – Rodrigue's formula, Legendre Polynomials – Generating function for $P_n(x)$ - Recurrence formulae for $P_n(x)$ – Orthogonality of Legendre polynomials.

Learning Outcomes:

- After completion of this unit, the student will be able to solve Bessel and Legendre's equations in terms of polynomials.

UNIT-II

Functions of a complex variable – Limit – Continuity -Differentiability – Analytic function – Properties – Cauchy – Riemann equations in cartesian and polar coordinates – Harmonic and Conjugate harmonic functions. Construction of analytic function using Milne's - Thomson method.

Learning Outcomes:

After completion of this unit, the student will be able to

- Define continuity and differentiability of complex functions.

- Apply Cauchy-Riemann equations to complex functions in order to determine the given complex function is analytic.

UNIT-III

Conformal Mapping: Some standard transforms – translation, rotation, magnification, inversion and reflection. Bilinear transformation – invariant points. Special conformal transformations: $w = e^z$, z^2, sinz and cosz.

Learning Outcomes:

- After completion of this unit, the student will be able to analyze images from z-plane to w-plane.

UNIT-IV

Complex integration: Line integral - Evaluation along a path – Cauchy's theorem – Cauchy's integral formula – Generalized integral formula. Singular point – Isolated singular point – Simple pole, Pole of order *m* – Essential singularity.

Learning Outcomes:

- After completion of this unit, the student will be able to make use of integration concepts for complex functions.

UNIT-V

Residues: Evaluation of residues. Cauchy's residue theorem – Evaluation of the real definite integrals of the type (i) Integration around the unit circle $\int_0^{2\pi} f(cos\theta, sin\theta)d\theta$ and (ii) integration around a small semi circle $\int_{-\infty}^{\infty} f(x)dx$

Learning Outcomes:

After completion of this unit, the student will be able to

- Make use of the Cauchy's residue theorem to evaluate certain integrals.
- Analyze real definite integrals in definite regions.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S Grewal, Khanna Publishers-44 edition, 2017.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Willey Publications, 10th edition Reprint 2021.
3. Advanced Engineering Mathematics, Neil Opeter V

4. Advanced Engineering Mathematics, Greenberg Michael D, Cengage Publishers.

Reference Books:

1. Higher Engineering Mathematics, B.V.Ramana, Mc.Graw Hill Education (India) Private Limited.
2. Advanced Engineering Mathematics by N. Bali, M Goyal & C.Watkins Firewall Media 17th edition Reprint 2015.
3. Engineering Mathematics, Volume – III, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.
4. Calculus an introduction to applied Mathematics, Greenspan Harvey P Benney David J Turner James E

Course Title	Signals and Systems					B. Tech ECE III Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004301	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**--**	**--**	**3**	**40**	**60**	**100**
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To introduce terminology of signals and systems.
- To present Fourier tools through the analogy between vectors and signals.
- To teach concept of sampling and reconstruction of signals.
- To present linear systems in time and frequency domains.
- To teach Laplace and z-transform as mathematical tool to analyze continuous and discrete-time signals and systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify the various signals and operations on signals.
CO 2	Describe the spectral characteristics of signals.
CO 3	Illustrate signal sampling and its reconstruction.
CO 4	Apply convolution and correlation in signal processing.
CO 5	Analyze continuous and discrete time systems.

UNIT-I

Introduction: Definition and Classification of Signals, Elementary signals, Basic operations on signals.

Fourier series representation of periodic signals: Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions. Representation of function by a set of mutually orthogonal functions, Dirichlet‟s conditions, Trigonometric Fourier series and Exponential Fourier series, Spectrum and its significance, Amplitude and Phase spectra, bandwidth of a signal.

UNIT-II

Fourier transform: Fourier transform, Fourier transform of standard signals, properties of Fourier transforms, Fourier transforms involving impulse function, Fourier transform of periodic signals.

UNIT-III

Discrete Time Signals: Sampling of continuous time signals, Sampling theorem, Reconstruction of signal from its samples, effect of under sampling – Aliasing. Elementary sequences- Unit impulse, step, ramp, and exponential sequences, Periodicity of Discrete-time signals, Operations on Discrete-time signals.

Convolution and correlation: Graphical method of convolution, auto correlation and Cross correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between convolution and correlation, Applications of convolution and correlation.

UNIT-IV

Response of LTI systems: Systems, Classification of Systems, Linear time invariant (LTI) system, Transmission of signals through LTI systems, Transfer function of a LTI system, Causality & Stability. Distortion less transmission through LTI system, Bandwidth of systems, relation between bandwidth and rise time.

Discrete Time Systems: Definition, classification, Linear Shift Invariant(LSI) system, Stability, Causality, Linear constant coefficient difference equation, Impulse response, Discrete time Fourier transform, Properties, Transfer function, System analysis using DTFT.

UNIT-V

Laplace Transform: Definition , ROC , Properties , Inverse Laplace transform , The S-plane and BIBO stability , Transfer functions , System response to standard signals.

Z–Transform: Definition, ROC and its properties, analysis of LTI system using Z-transform, The Inverse Z-transform using, Z-transform properties, Unilateral Z- Transform, solution of linear constant coefficient difference equations using Z-transforms.

Text Books:

1. Simon Haykin, Van Veen, and Wiley, “Signals & Systems”, 2nd Edition, 2003.
2. Oppenheim AV and Willisky, “Signals and Systems”, 2nd Edition, Pearson Ed, 1997.
3. B.P. Lathi, “Principles of Linear systems and signals,” Oxford Univ. Press, Second Edition International version, 2009.

Reference Books:

1. Simon Haykin, “Communication Systems”, 2nd Edition, Wiley-Eastern, 2003.
2. Luis F. Chaparro, “Signals and Systems using MATLAB,” Academic Press, 2011.
3. P. Ramesh Babu, R. Ananda Natarajan, “Signals and Systems”, 2nd edition, SciTech Publications, 2006.
4. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing, Principles, Algorithms ,and Applications”, 4 th Edition, PHI, 2007.

<table>
<tr><td>Course Title</td><td colspan="4">Digital System Design</td><td colspan="3">B. Tech ECE III Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004302</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To provide fundamentals of number systems and Boolean algebra.
- To learn the design of combinational and sequential circuits.
- To teach various memories and PLDs.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify various number systems and binary codes.
CO 2	Understand the postulates, theorems and properties of Boolean algebra.
CO 3	Show the correlation between the Boolean expression and their corresponding logic diagram.
CO 4	Analyze Combinational & sequential logic circuits.
CO 5	Solve Switching functions using Programmable Logic Devices

UNIT-I

Number Systems & Codes: Overview of number systems –complement representation of negative numbers- binary arithmetic, binary codes, code conversion, error detecting & error correcting codes – Hamming codes.

UNIT-II

Boolean algebra and Minimization of Switching Functions: Fundamental postulates of Boolean algebra - Basic theorems and properties –Canonical and Standard forms- Minimal SOP and POS forms, Algebraic simplification, The K- map method, tabulation method.

Realization of Logic Gates Using Diodes & Transistors: Diode AND gate, Diode OR Gate & Transistor NOT gate, Diode-Transistor Logic (DTL), Resistor-Transistor Logic (RTL), Resistor Capacitor-Transistor Logic (RCTL), Direct-Connected Transistor Logic (DCTL), Emitter-Coupled Logic (ECL) and Transistor-Transistor Logic (TTL) Families, and comparison among the logic families, digital logic gates –universal gates-Multilevel NAND/NOR realizations.

UNIT-III

Combinational Logic Design: Design using conventional logic gates, Half and Full Adders, Sub tractors, Serial and Parallel Adders, Encoder, Decoder, Multiplexer, De-Multiplexer, Realization of switching functions using multiplexer, Parity bit generator, Code-converters, Hazards and hazard free realizations.

UNIT-IV

Sequential Logic Design: Synchronous and Asynchronous sequential circuits, Flip-flops- Triggering and excitation tables, Flip flop conversions, shift registers, Design of Synchronous and Asynchronous counters, Ring and Johnson counters. Finite state machines (Mealy Model, Moore Model) and their representation, Designing synchronous Sequential circuits like Serial Binary adder, Sequence detector.

UNIT-V

Semiconductor Memories and Programmable Logic Devices: ROM- Internal structure, Static RAM and Dynamic RAM. Basic PLD‟s-ROM, PROM, PLA, and PAL, Realization of Switching functions using basic PLD‟s. Concept of PLD‟s like CPLDs and FPGAs.

Text Books:

1. ZVI Kohavi, "Switching & Finite Automata theory" –, TMH, 2nd Edition.
2. Morris Mano, "Digital Design", PHI, 3rd Edition, 2006.
3. Jacob Millman and Herbert Taub Pulse, Digital and Switching Waveforms –McGraw-Hill, 1991

Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.
3. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989.
4. William I. Fletcher, "An Engineering Approach to Digital Design", PHI.
5. A. Anand Kumar, "Switching Theory & Logic Design", 2008, PHI.
6. Pulse and Digital Circuits – A.Anand Kumar, PHI, 2005.

Course Title	**Analog Circuits**					**B. Tech ECE III Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004303	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**--**	**--**	**3**	**40**	**60**	**100**
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- Learn the concepts of high frequency analysis of transistors.
- To give understanding of various types of amplifier circuits such as small signal, cascaded, Large signal and tuned amplifiers
- To familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback.
- To construct various multi vibrators using transistors and sweep circuits

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify the multistage amplifiers.
CO 2	Understand the concepts of High Frequency Analysis ofTransistors.
CO 3	Show the improvement in stability of amplifiers using negative feedback and positive feedback to generate sustained oscillations.
CO 4	Analyze different classes of Power Amplifiers and tuned amplifiers useable for audio and Radio applications.
CO 5	Design Multivibrators and sweep circuits for various applications.

UNIT-I

Multistage and Differential Amplifiers

Introduction – Recap of Small Signal Amplifiers, Multistage Amplifiers, Cascode amplifier, Darlington pair, the MOS Differential Pair, Small-Signal Operation of the MOS Differential Pair, The BJT Differential Pair, and other Non-ideal Characteristics of the Differential Amplifier.

UNIT-II

High Frequency Response of Transistors: Hybrid - model of Common Emitter transistor model, f_α, f_β and unity gain bandwidth, Gain-bandwidth product. High Frequency response of CG amplifier.

UNIT-III

Feedback Amplifiers: Concepts of feedback – Classification of feedback amplifiers – General Characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics– Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems.

Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge

Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

UNIT-IV

Large Signal Amplifiers: Class A Power Amplifier- Series fed and Transformer coupled Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class –C Amplifiers.

Tuned Amplifiers: Introduction, single Tuned Amplifiers – Q-factor, frequency response of tuned amplifiers, Concept of stagger tuning and synchronous tuning.

UNIT-V

Multi vibrators: Analysis of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

Time Base Generators: General features of a Time base Signal, Methods of Generating Time Base Waveform, concepts of Transistor Miller and Bootstrap Time Base Generator, Methods of Linearity improvement.

Text Books:

1. Adel. S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits," 6th Edition, Oxford University Press, 2011.
2. Jacob Millman, Christos C Halkias, "Integrated Electronics", McGraw Hill Education
3. Thomas L. Floyd, "Electronic Devices Conventional and current version", 2015- Pearson

Reference Books:

1. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford.
2. Robert L. Boylestead, Louis Nashelsky, "Electronic Devices and Circuits theory", 11th Edition,2009, Pearson

<table>
<tr><td>Course Title</td><td colspan="4">Network Theory</td><td colspan="3">B. Tech ECE III Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004304</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To learn network theorems,
- To teach application of resonance, transients applied for ac and dc circuits
- To study necessary conditions for network functions, various parameters and its relationships.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand network topology.
CO 2	Compute RL, RC and RLC for DC transient response.
CO 3	Solve RL, RC and RLC circuits for AC response.
CO 4	Analyze two port networks for Z, Y, ABCD, H parameters and its relationship between them.
CO5	Apply network synthesis procedure to RC, RL and LC circuits.

<u>UNIT-I</u>

Network topology: Introduction, definitions, formation of incidence matrix, cutest, tie set, loop current method of analysis, crammer's method, driving point and transfer impedance, dual networks, procedure to obtain dual network.

<u>UNIT-II</u>

DC Transient Analysis: Determination of initial conditions – transient response of R-L, R-C & R-L-C circuits for dc–solution method using differential equation and Laplace transforms.

<u>UNIT-III</u>

AC Analysis: Response of R-L, R-C and R-L-C series circuits for sinusoidal excitations, solution method using differential equation and Laplace transforms.

Resonance: Series, parallel circuits, concept of half power frequencies, bandwidth and Q factor. Simple problems.

UNIT IV

Two port Networks: one port, two port and n-port networks, driving point impedance and admittance, transfer impedance and admittance, voltage and current ratios, impedance parameters, admittance parameters, transmission parameters, hybrid and inverse hybrid parameters, relationship between parameters, conditions for symmetry and reciprocity.

UNIT V

Network Synthesis: Causality and Stability, Positive Real Function, Hurwitz Polynomial, Testing Driving Point Immittances, Elementary Synthesis Procedures, Properties of RL,RC,LC Immittances.

Text Books:

1. M.E Van Valkenburg "Network Analysis" –- 3rd edition, PHI, 2015.
2. Hayt and Kimmerly "Engineering circuit analysis", 7th edition, TMH, 2010.

Reference Books:

1. A. Sudhakar, Shayammohan. S. Pillai "Circuits & Networks" –, 4th Edition –. TMH, 2013.
2. Stanley "Network Analysis with applications", 4th edition, Pearson education, 2004.
3. D. Roy Chowdari "Networks and Systems" — New Age International
4. "Fundamentals of Electrical Networks" by BR Guptha and V.Singhal, S.Chand.
5. N.Sreenivasulu, "Electrical Circuits", Reem publications, 2012.
6. A.Chakrabarti, "Circuit Theory", seventh edition, Dhanapat Rai & Co publications, 2015.

Course Title	Simulation Lab					B. Tech ECE III Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004305	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		-	**--**	**3**	**1.5**	**40**	**60**	**100**
					End Exam Duration: 3Hrs			

Course Objectives:
- To understand the signal properties and different transforms by using mat lab.
- To understand the simulation software.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the main features and importance of the MATLAB/ SCI LAB or OCTAVE mathematical programming environment.
CO 2	Apply working knowledge of MATLAB/ SCI LAB or OCTAVE package to simulate the basic signals.
CO 3	Verify the properties of basic signals.
CO4	Analyze the Frequency characteristics of signals.

Any 12 experiments of the following

List of Experiments:

1. Basic Operations on Matrices
2. To Generate Various signals and Sequences (Periodic and Aperiodic), Such as Unit Impulse, Unit Step, Square, Saw Tooth, Triangular, Sinusoidal, Ramp, sinc function.
3. To perform various Operations such as Addition, Multiplication, Scaling, Shifting, Folding on Signals and Sequences.
4. To Compute Energy and Average Power of a signal.
5. To find the Even and Odd Components of Signal or Sequence and Real and Imaginary Parts of Signal.
6. To compute Convolution of any two Signals and Sequences.
7. Autocorrelation and Cross correlation between Signals and Sequences.
8. Verification of Linearity and Time Invariance Properties of a Given Continuous / Discrete System.
9. Computation of Unit Sample, Unit Step and Sinusoidal Responses of the Given LTI System and Verifying its Physical Reliability and Stability Properties.
10. Finding the Fourier Transform of a given Signal and plotting its Magnitude and Phase Spectrum.
11. Waveform Synthesis using Laplace Transform.

12. Locating Zeros and Poles, and plotting the Pole-Zero maps in S-Plane and Z-Plane for the given Transfer Functions.
13. Sampling Theorem Verification.
14. Removal of Noise by Auto Correlation / Cross correlation in a given signal corrupted by noise.

Note: MATLAB /SCI LAB /OCTAVE SOFTWARE is used for the above experiments.

<table>
<tr><td>Course Title</td><td colspan="5">Digital System Design Lab</td><td colspan="3">B. Tech ECE III Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004306</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>--</td><td>--</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To simplify and implement different Boolean expressions.
• To design and verify the combinational circuits
• To design and verify sequential circuits.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this laboratory course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Simplify, design and implement Boolean expression/half and full adders using basic/universal gates.</td></tr>
<tr><td>CO 2</td><td colspan="8">Design and implement the various combinational circuits</td></tr>
<tr><td>CO 3</td><td colspan="8">Implement and verify the truth tables of various flip-flops</td></tr>
<tr><td>CO 4</td><td colspan="8">Design and implement the registers and sequence generator.</td></tr>
<tr><td>CO 5</td><td colspan="8">Design and implement the counters.</td></tr>
</table>

List of Experiments:

1. Verification of outputs of all Logic Gates- 74XX

2. Design and verify the truth tables of Half Adder, Full Adder

3. Design and verify the 4-bit Binary Full Adder -7483 using 1 bit full adder.

4. Design and verify the 3-8 Decoder -74138.

5. Design and verify the 8-3 Encoder- 74X148

6. Design and verify the 8 x 1 Multiplexer -74X151

7. Design and verify the 4 bit Comparator-74X85

8. Design and verify the truth table of D Flip-Flop 74X74

9. Design the Decade counter-74X160 or 7490 and verify the output.

10. Design any Mod-Counters and verify the output.

11. Verify the shifting operation of 4-bit R/L shift register -7495

12. Verify the output of Ring counter

13. Verify the output of Johnson counter

<table>
<tr><td>Course Title</td><td colspan="5">Analog Circuits Lab</td><td colspan="3">B. Tech ECE III Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004307</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>--</td><td>--</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- The objective of the course is to verify theoretically and practically all the experiments, analyze the characteristics of BJT, design the oscillators, feedback amplifier circuits, power amplifier circuits and multi-vibrator circuits from the

Course Outcomes: On successful completion of this laboratory course, the students will be able to

CO 1	Verify the characteristics of amplifiers with and without feedback.
CO 2	Observe the output waveforms of different oscillators.
CO 3	Analyze the characteristics of power amplifiers.
CO 4	Design monostable Multivibrator circuit.

List of Experiments:

1. Design & Analysis of frequency Response of Common Emitter Amplifier
2. Design & Analysis of Frequency Response of Common Source Amplifier
3. Design & Analysis of Frequency Response of Common Drain Amplifier
4. Verify the Frequency Response of Two Stage RC Coupled Amplifier
5. Verify the Frequency Response of Cascode amplifier Circuit
6. Verify the Frequency Response of Darlington Pair Circuit
7. Verify the Frequency Response of Current Shunt Feedback amplifier Circuit
8. Verify the Frequency Response of Voltage Series Feedback amplifier Circuit
9. Design and verify RC Phase shift Oscillator Circuit (using MOSFET)
10. Design and verify Hartley and Colpitt’s Oscillators Circuit
11. Verify the Frequency Response of Class A power amplifier
12. Verify the Frequency Response of Class B Complementary symmetry amplifier
13. Design and verify a Monostable Multivibrator
14. Design and verify Miller Sweep Circuit.

<table>
<tr><td>Course Title</td><td colspan="5">Python Programming</td><td colspan="3">B. Tech ECE III Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20SC308</td><td rowspan="2">SC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>1</td><td>--</td><td>2</td><td>2</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To write, test, and debug simple Python programs.
• To implement Python programs with conditionals and loops.
• Use functions for structuring Python programs.
• Represent compound data using Python lists, tuples and dictionaries.
• Read and write data from/to files in Python</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Demonstrate the functions in Python programming.</td></tr>
<tr><td>CO 2</td><td colspan="8">Illustrate Python programs with conditionals and loops.</td></tr>
<tr><td>CO 3</td><td colspan="8">Test functions for structuring Python programs.</td></tr>
<tr><td>CO 4</td><td colspan="8">Design functions for structuring Python programs.</td></tr>
<tr><td>CO 5</td><td colspan="8">Evaluate compound data using Python lists, tuples, dictionaries.</td></tr>
</table>

List of Programs:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Find the Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. To implement Linear search and Binary search
6. To implement Selection sort, Insertion sort
7. To Merge and sort the given list
8. To obtain First n prime numbers
9. Multiplication of matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file

12. To solve a given circuit diagram

13. To perform mesh analysis of electrical cicuit.

Platform Needed:

Python 3 interpreter for Windows/Linux

Course Title	**Universal Human Values**					**B. Tech ECE III Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20MC309	**MC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**40**
Mid Exam Duration: 2Hrs								

Course Objectives:

- To understand the moral values that ought to guide the Management profession and resolve the moral issues in the profession,
- To justify the moral judgment concerning the profession.
- To develop a set of beliefs, attitudes, and habits that engineers should display concerning morality.
- To create an awareness on Management Ethics and Human Values.
- To inspire Moral and Social Values and Loyalty.
- To appreciate the rights of others.

This course deals with professional ethics which includes moral issues and virtues, social responsibilities of an engineer, right qualities of moral leadership

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Develop appropriate technologies and management patterns to create harmony in professional and personal life.
CO 2	Ensure students sustained happiness through identifying the essentials of human values and skills.
CO 3	Get awareness of types of ethical challenges and dilemmas confronting members of a range of professions (business, media, police, law, medicine, research)
CO 4	Bring to bear ethical analysis and reasoning in the light of normative ethics frameworks on a selection of ethical challenges and dilemmas across the chosen range of professions
CO 5	Relate ethical concepts and materials to ethical problems in specific professions and professionalism

UNIT-I

HUMAN VALUES

Morals, Values and Ethics - Integrity - Trustworthiness - Work Ethics - Service Learning - Civic Virtue - Respect for others - Living Peacefully - Caring - Sharing - Courage - Value Time - Co-operation - Commitment - Empathy - Self-confidence - Spirituality - Character.

UNIT-II

ENGINEERING ETHICS

Senses of Engineering Ethics – Variety of Moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's Theory – Consensus and Controversy – Professions and Professionalism – Professional ideals and virtues.

UNIT-III

ENGINEER'S RESPONSIBILITY FOR SAFETY

Safety and Risk – Assessment of Safety and Risk – Risk benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk – Chernobyl Case and Bhopal Case studies.

UNIT- IV

VALUE EDUCATION

Self- exploration- its content and process- natural acceptance- Happiness and Prosperity- Understanding Human relations.

UNIT-V

HOLISTIC PERCEPTION OF HARMONY

Understanding the Harmony in the society- -Universal order- critical appreciation of Human values- Justice, Trust.

Text Books :

1. Mike martin and Roland Schinzinger.“ Ethics in Engineering '', McGrow Hill, New York 2005
2. Charles E Harris. Michael S Pritchard and Michael J Rabins.“ Engineering Ethics – Concepts and Cases ”, Thompson Learning 2000.
3. R R Gaur, R Asthana, G P Bagaria, “A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1

Reference Books:

1. Charles D Fleddermann, “ Engineering Ethics”, Prentice Hall, New Mexico, 1999.
2. John R Baatright. “Ethics and the Conduct of Business”, Pearson Education 2003.
3. Edmund G Seeabauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University press 2001.
4. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amar kantak, 1999.
5. A. N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, 2004.

B.Tech IV SEM ECE (R20)

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Course Title	Business Economics and Accounting for Engineers					B. Tech ECE IV Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2025401	HSC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	-	3	40	60	100
Mid Exam Duration:90Minutes					End Exam Duration :3Hrs			

Course Objectives:

- To equip the budding engineering student with an understanding of concepts and tools economic analysis.
- To provide knowledge of Business economics through differential economics concepts ar theories.
- To make aware of accounting concepts to analyze and solve complex problems relatir financial matters in industries.
- To understand professional and ethical responsibility and ability to communicate effectively.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Understand the concept of Business Economics and able to apply
CO2	UnderstandtheProductionfunctionsandapplicationofBusinessEconomicsand Accounts for making business decision.
CO3	To Analyze the markets conditions and determine price-output relations.
CO4	Tounderstandtheconceptsofaccountingandabletopreparethefinancialstatements of The business firm.
CO5	To evaluate, analyze and interpret the financial performance of business.

UNIT- I

INTRODUCTION TO BUSINESS ECONOMICS

Meaning, Definition, Nature and scope of Business Economics, Demand Analysis: Concept of Demand, Determinants of demand, Law of Demand and its exceptions, Elasticity of Demand –Types, Measurement of Elasticity of Demand, Demand Forecasting – Techniques of Demand Forecasting.

UNIT-II

THEORYOFPRODUCTIONANDCOSTANALYSIS

Production Functions: Law of variable proportion, Iso quants and Isocost, least cost combination of inputs, Returns to Scale and Cobb- Douglas production function. Internal and external economies of scale.

Cost Analysis: Cost concepts – Break-Even Analysis (BEA) – Break Even Point – significance and limitations of BEA.

UNIT-III

CLASSIFICATIONOFMARKETS ANDPRICINGMETHODS

Markets structures: Perfect and Imperfect competition–Features of Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly. Price- Output determination under perfect competition, monopoly and monopolistic competition– Price rigidity in Oligopoly.

Methods of Pricing – cost plus pricing, marginal cost pricing, skimming pricing, penetration pricing, differential pricing and administrative pricing.

UNIT-IV

INTRODUCTIONTOFINANCIALACCOUNTING

Definition to Accounting, objective and need for Accounting, Double Entry Book keeping – Accounting process, Journal Ledger, Trial Balance, and Final Accounts– Trading Account, Profit and Loss Account and Balance sheet with problems.

UNIT–V

FINANCIALANALYSISTHROUGHRATIOS

Concept of Financial Ratios, Types of Ratios– Liquidity Ratios, Turnover Ratios, Capital Structure Ratios, Profitability Ratios with problems.

Text Books:

1. Introductory Managerial economics for BMS; MithaniDM,PERASON
2. management science:Principles and world wide application,SalvatoreDominick.PEARSON
3. A.RamachandraAryasri:ManagerialEconomicsandFinancialAnalysis,PEARSON
4. Varshney&Maheswari:ManagerialEconomics, SultanChandPublishers, 2009.
5. PrasadandK.V.Rao:FinancialAccounting,JaiBharathPublishers,Vijayawada.
6. A.R.Aryasri:ManagerialEconomicsandFinancialAnalysis,TATAMcGraw-HillPublishingCo.Ltd.

Reference Books:

1. Managerial economics (Economics tools for today's Decision Makers),PalG.Keat,Philip K.Y. Young, Stephen E.Erfle, SreejataBanerjee,PEARSON
2. P.LMehtha:ManagerialEconomics,SulthanChandPublishers
3. KKDewett -ManagerialEconomics,S.ChandPublishers
4. S.PJain&K.LNarang:FinancialAccounting,Kalyanipublishers.
5. M.SugunathaReddy:ManagerialEconomicsandFinancialAnalysis,ResearchIndiaPublication,New Delhi,2013.
6. PaulASamulesonandWilliamnordhaus:Economics, OxfordUniversityPublications.

<table>
<tr><td>Course Title</td><td colspan="4">Probability Theory and Stochastic Processes</td><td colspan="3">B. Tech ECE IV Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2021403</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- The Objective of this course is to provide the students with knowledge about the random variable and random processes.
- To model the random processes in the communication system such as receiver performance, interference, thermal noise, and multipath phenomenon.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Interpret probability by modeling sample spaces
CO 2	Understand various random processes like Gaussian, Exponential, Uniform and Poisson processes experimentally.
CO 3	Compute PSD of Random process.
CO 4	Analyze solutions for complex engineering problems involving random processes
CO 5	Solve the linear system challenges with random inputs.

UNIT-I

Probability: Probability definition, Event, Sample space, Axioms, Joint and conditional probability, Independent events, Total probability theorem, Baye’s theorem, Bernoulli trials.

Random Variable: Concept, Distribution function, Density function, Conditional distribution and density functions.

UNIT-II

Operations on Single random variables: Expectation, Conditional expected value, Moments, Chebyshev, Markov‟s and Chernoff‟s inequalities, Characteristics and moment generating functions, Transformation of continuous and discrete random variable.

UNIT-III

Multiple Random Variables: Vector random variables, Joint distribution & Density functions, Conditional density & Distribution functions, Statistical independence, pdf and cdf for sum of random variables, Central limit theorem, Operations on multiple random variables, Expected value of function of random variables, Joint characteristic function, Joint by Gaussian random variables, Transformations of multiple random variables.

UNIT-IV

Random Processes : Concept, Stationary, Independence, Time averages, Ergodicity, Correlation functions and its properties, Gaussian, Poisson, and Markov processes, Power spectral density and its properties, Relation between power spectral density and auto- correlation, Cross power spectral density and its properties, Power spectrum for discrete time processes and sequences, Definition of white and colored noise.

UNIT-V

Linear Systems with Random Inputs: Random signal response of linear system, System evaluation using random noise, Spectral characteristics of system response, Noise bandwidth, Band pass, Band limited, and Narrow band processes, Properties of band limited processes.

Text Books:

1. P.Z. Peebles Jr., "Probability Random Variables and Random Signal Principles", Tata McGraw-Hill, 4th Edition, 2001.
2. A. Papoulis and S. Unnikrishna Pillai, "Probability Random Variablesand Stochastic Processes", 4th Edition, PHI,2007

Reference Books:

1. S.P. Eugene Xavier, "Statistical Theory of Communication", New Age Publications, 2003.
2. B.P. Lathi, "Signals, Systems & Communications", B.S. Publications,2003.
3. G.R. Babu and K. Pushpa, "Probability Theory and Stochastic Processes", Premier Publishing House.
4. D. G. Childer, "Probability and Random Processes", McGraw Hill, 1997.
5. Hwei P. Hsu, Ph.D., "Theory and Problems of Probability, Random Variables,and Random Processes", Schaum's Outline Series, McGraw Hill, New York,1968.
6. B.P. Lathi, "Modern Digital and Analog Communication Systems," Third

   Edition, OXFORD University press, 1998.

Course Title	Microprocessors & Microcontrollers					B. Tech ECE IV Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004403	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**--**	**--**	**3**	**40**	**60**	**100**
Mid Exam Duration: 2 Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To become familiar with 8086 Microprocessor and 8051 Microcontroller Architecture, Instructions, Operating Modes and Programming.
- To use 8086 microprocessor and 8051 microcontroller for various applications.
- To study various peripherals for microprocessor based systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define various components and list out various features of microprocessor, microcontroller and peripherals.
CO 2	Describe the internal block diagram of microprocessor, microcontroller and peripherals, addressing modes, instruction set and data transfer schemes.
CO 3	Develop algorithm and assembly language programs to solve problems.
CO 4	Apply an appropriate algorithm, program and peripheral for the application.
CO 5	Design the microprocessor or microcontroller based system to solve real time problems. (Prepare a case study model to get a first prototype)

UNIT-I

The 8086 Microprocessor–Introduction to microprocessors, 8086 microprocessor Architecture, Instruction set, Addressing modes, Interrupt system. Pin diagram, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings.

UNIT-II

Assembly Language Programming: Assembler directives, Assembly language programs (8086) with Assembler directives for addition, subtraction, multiplication, division etc., sorting and searching, bit manipulation, look-up tables, string manipulations, Macros and Delay subroutines.

Data transfer schemes and Memory Interfacing: Synchronous, Asynchronous, Interrupt driven and DMA type schemes, Address decoding techniques, Interfacing Static RAM and ROM chips.

UNIT-III

Peripheral Interfacing: 8255 PPI and its interfacing, Programmable Communication Interface (8251 USART) and its interfacing, Programmable Interval Timer (8254) and its interfacing, Programmable interrupt controller (8259) and its interfacing, Programmable DMA controller (8257) and its interfacing, ADC and DAC Interfacing.

UNIT-IV

The 8051 microcontroller: Architecture, pin diagram, memory organization, external memory interfacing, stack, addressing modes, instruction set, Assembler directives, Assembly Language programs and Time delay Calculations, 8051 interrupt structure, 8051 counters and Timers, programming 8051 timers.

UNIT-V

Introduction to ARM: ARM Design philosophy, Registers, Program Status Register, Instruction pipeline, Interrupts and vector table, Instruction Set- Data Processing Instructions, Branch, Load-Store, Software interrupt, PSR instructions, Conditional instructions, Thumb instruction Set: Register Usage, Other Branch instructions, Data processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions.

Text Books:

1. Ramesh S. Gaonkar, "Microprocessor architecture, programming and its applications with 8085", Penram International Publications, 4thEdition.
2. A. K. Ray and K.M. Bhurchandi, "Advanced Microprocessors and Peripherals", TMH.
3. Mazidi Muhammad Ali, Mazidi Janice Gillespie &McKinlayRolin D, "The 8051Microcontroller and Embedded Systems", 2nd Edition, Pearson Education, 2008.
4. Kenneth J Ayala, "The 8051 microcontroller: Architecture, Programming & Applications", Penram publications, 2nd edition.
5. Andrew N.Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide-Designing and Optimizing system software", Elsevier, 2008.

Reference Books:

1. Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware", 2nd Edition, Tata McGraw-Hill.
2. Barry B. Brey, "The Intel Microprocessors-Architecture, Programming and Interfacing", 8th Edition, PHI.
3. Y. Liu and Glenn A. Gibson, "Microcomputer Systems: 8086/8088 Family Architecture, Programming and Design", 2nd Edition, PHI.
4. Raj Kamal,"Microcontrollers Architecture, Programming, Interfacing and System Design", Pearson Education, 2005.
5. Steve Furbur, "ARM System on-chip Architecture",2nd Edition, Addison Wesley, 2000.

Course Title	Electro Magnetic Waves And Transmission Lines					B. Tech ECE IV Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004404	PCC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	--	--	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- Understanding and increasing the ability to use vector algebra, and vector calculus.
- Proficiency in the use of vector identities, and various Coordinate systems & transformations.
- Providing the basic education in static electromagnetic fields and time varying electromagnetic waves.
- Developing analytical skills for understanding propagation of electromagnetic waves in different media.
- Understanding the concepts of transmission lines & their applications

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basics of Electro Statics and Magneto Statics.
CO 2	Apply Maxwell's equations in the derivation of fields.
CO 3	Calculate Electric and magnetic fields due to various sources.
CO 4	Analyze the wave propagation in different media.
CO 5	Describe the transmission line equations and compute various parameters.

UNIT-I

Electrostatics: Review of Vector algebra, Co-ordinate systems & transformation, Vector calculus, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations between E and V, Maxwell's two Equations for Electrostatic Fields, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

UNIT-II

Magneto statics: Biot-savart's law, Ampere's law and applications, Magnetic flux density,Maxwell's two equations for magneto static fields, magnetic scalar and vector potentials, Forces due to Magnetic fields, Ampere's force law, inductances and magnetic energy, illustrative problems.

UNIT-III

Maxwell's Equations (Time varying fields): Faraday's law and transformer emf, Inconsistency of ampere's law and displacement current density, Maxwell's equations in different final forms and word statements, conditions at boundary surface: Dielectric- Dielectric and Dielectric-conductor interfaces, illustrative problems.

UNIT-IV

EM wave characteristics: Wave equations for conducting and perfect dielectric media, Uniform plane waves-Definition, All relations between E&H, Sinusoidal variations, Wave propagation in loss less and conducting media, conductors& dielectrics- characterization, wave propagation in good conductors and good dielectrics, polarization.

Reflection and Refraction of plane waves: Normal and Oblique incidences for both perfect conductors and dielectrics, Brewster angle, Critical angle and total internal reflection, Surface impedance, pointing vector and pointing theorem-applications, power losses in a plane conductor, illustrative problems

UNIT-V

Transmission lines: Types, parameters, Transmission line equations, Primary & Secondaryconstants, Expression for characteristic impedance, Propagation constant, Phase and group velocities, Loss less and low loss characterization, Distortion- condition for Distortion less and minimum attenuation, input impedance relations, SC and OC lines, Reflection coefficient, VSWR, Smith chart & its applications, illustrative problems.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed.,2008.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics," TMH, 7th ed.,2006.
3. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems" PHI,2nd ed., 2000.

Reference Books:

1. John D. Krauss, "Electromagnetics", McGraw- Hill publications, 3rd ed., 1988.
2. John D. Ryder, "Networks, Lines, and Fields," PHI publications, Second Edition, 2012.
3. Schaum's out – lines, "Electromagnetics", Tata McGraw-Hill publications, Second Edition, 2006

<table>
<tr><td>Course Title</td><td colspan="5">Linear and Digital IC Applications</td><td colspan="3">B. Tech ECE IV Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004405</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To give introduction to Op-Amps.
- To study about Timers and PLLs.
- To learn the applications of Op-Amps.
- To introduce Verilog and its language elements to design digital systems
- Make students familiar with design of different combinational and sequential digital circuits.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the operation and characteristics of OP-AMPs, CMOS, Bipolar logic families and its interfacing.
CO 2	Applying basic equations and compute the parameters of Multi-vibrators.
CO 3	Analyze the circuits with OP-AMPs, 555timers.
CO 4	Apply the concepts of Verilog HDL for modeling and simulation of digital logic circuits.
CO 5	Design op-amp, 555timer circuits and logic circuits.

UNIT-I

OP-AMP AND ITS CHARACTERISTICS: Differential Amplifier- DC and AC analysis of Dual input Balanced output Configuration, Properties of other differential amplifier configuration (Dual Input Unbalanced Output, Single Ended Input Balanced/ Unbalanced Output), Integrated circuits -types, classification, package types and temperature ranges, power supplies, OP-Amp Block diagram, ideal and practical OP-Amp specifications, DC and AC characteristics, Frequency Compensation. 741 OP-Amp and its features, Inverting and non-inverting amplifier.

UNIT-II

OP-AMP APPLICATIONS: Summer, Subtractor, Integrator and differentiator, instrumentation amplifier, AC amplifier, V-I, I-V converters, comparators, Multivibrators, Triangular and square wave generators, precision rectifiers. Introduction to Analog Active Filters, Design and analysis of first order and second order LPF and HPF.

UNIT-III

TIMERS, PLL, D-A and A-D Converters: Introduction to 555 Timer, Functional diagram, Monostable and Astable operations, PLL-Introduction, Block schematic, principles and description of individual blocks, IC 565 and PLL applications. Weighted resistor DAC, parallel comparator type ADC and dual slope integration type ADC.

UNIT-IV

CMOS Logic and Interfacing: CMOS logic, CMOS NAND and NOR gates, CMOS AOI and OAI gates, CMOS steady state and dynamic electrical behavior, CMOS logic families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing. CMOS transmission gates, Bi-CMOS. Familiarity with standard 74XX and CMOS 40XX series-ICs – Specifications and Applications.

UNIT-V

Verilog HDL AND DESIGN EXAMPLES: HDL based Design flow, **Verilog** Program Structure, Nets, Variables and Constants, Vectors and Operators, Arrays, Logical Operators and Expressions. **Verilog** modeling styles: Structural design elements, data flow design elements, behavioral design elements (procedural code). Design using basic gates, Decoders, Encoders, Multiplexers, Adders, Subtractors, SSI Latches and Flip-Flops, Counters and Shift Registers. **Verilog** Modules for the above ICs.

Text Books:

1. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", 4th edition, PHI, 1987.
2. John F. Wakerly, "Digital Design Principles & Practices" PHI/Pearson Education Asia, 4th Edition,2008.
3. J. Bhasker, "A Verilog HDL Primer", Star Galaxy Publishing; 3rd edition (January 31, 2005)

Reference Books:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International (P) Ltd, 2nd Edition, 2003.
2. James M.Fiore, "Operational Amplifiers & Linear integrated circuits & applications", Cengage 2009.
3. Fundamentals of Digital Logic with Verilog Design – Stephen Brown, Zvonko Vranesic, TMH, 3rd Edition, 2014

<table>
<tr><th>Course Title</th><th colspan="4">Linear and Digital IC Applications Lab</th><th colspan="4">B. Tech ECE IV Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">2004406</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>--</td><td>--</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To verify various op-amp applications.
- To verify the applications of different ICs.
- To write Verilog HDL programs for different logic circuits.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate the circuits with analog IC's (741, 555, 78XX/79XX, 723).
CO 2	Apply IC's (741, 555, 78XX/79XX, 723) in electronic applications.
CO 3	Design a digital system with Verilog to meet required specifications.
CO 4	Test the functionality of system design with Verilog Test Benches.
CO 5	Test the results of designed digital system using FPGA.

Part A: Analog IC Application Lab:

1. Design and verify the OP AMP – Adder, Subtractor, Comparator Circuits.
2. Design and verify active filters LPF, HPF (first order).
3. Design and verify Function Generator using OP AMPs.
4. Design and verify IC 555 Timer – Monostable and Astable Operation Circuit.
5. Design and verify IC 566 – VCO Applications.
6. To verify the characteristics of Voltage Regulator using IC 723.
7. Design and verify 4 bit DAC using OP AMP.
8. To verify the characteristics of Precision Diodes.

Part B: Digital IC Applications:

(Simulate the internal structure of the following Digital IC's using Verilog HDL)

1. Logic Gates- 74XX.
2. Half Adder, Half Subtractor, Full Adder, Full Subtractor & Ripple Carry Adder.
3. 3-8 Decoder -74138 & 8-3 Encoder- 74X148.
4. 8 x 1 Multiplexer -74X151 and 2x4 Demultiplexer-74X155.
5. 4 bit Comparator-74X85.
6. D Flip-Flop 74X74.
7. JK Flip-Flop 74X109.
8. Decade counter-74X90.

Software Required -- Xilinx Vivado

Hardware Required -- FPGA Trainer Kits

Course Title	Microprocessors and Microcontrollers Lab					B. Tech ECE IV Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004407	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		--	**--**	**3**	**1.5**	**40**	**60**	**100**
					End Exam Duration: 3Hrs			

Course Objectives:

- To write 8086microprocessor and 8051 microcontroller programs for various operations
- Learning interfacing of processor with various Peripherals.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Develop algorithm and assembly language programs to solve problems.
CO 2	Analyze abstract problems and apply a combination of hardware and software to address the problem.
CO 3	Choosing an appropriate algorithm, program and peripheral for the application.
CO 4	Design the microprocessor based system to solve real time problems.

General Programs:

1. Addition and Subtraction of two 8- bit/16 bit numbers, Multiplication of two 8-bit & two 16-bit numbers, Division of 16-bit by 8-bit and 32-bitby 16-bit number
2. Addition and Subtraction of 6 data bytes with 6-data bytes of another location.
3. Check the given Number is even or odd, Counting of 0's and 1's in a given data, Check the given number is logical palindrome or not.
4. Finding the maximum and minimum numbers in a given string of data.
5. Sorting the given numbers in ascending and descending order.
6. Finding the Factorial and Generating Fibonacci Series.
7. Conversion of BCD to hexadecimal number, Multiplication of two 3x3 matrices.
8. Addition, Subtraction, Multiplication, Division using Microcontroller.

Interfacing:

1. Dual DAC interface (waveform generation).
2. Stepper motor control.
3. Display of flags using logic controller.
4. Traffic light controller.

Course Title	LABVIEW Programming Lab					B. Tech ECE IV Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004408	PCC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		-	-	3	1.5	40	60	100
					End Exam Duration: 3Hrs			

Course Objectives:

- To write, test, and debug basic Lab View programs.
- To implement Lab View programs with conditional statements.
- To perform operations on arrays and strings.
- Use SubVi‟s for Signal Generation, spectral measurements and filtering based Lab View programs.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Write basic Lab View Programs
CO 2	Implement Lab View programs with conditional statements.
CO 3	Perform operations on arrays and strings
CO 4	Implement digital logic circuits using Lab view program
CO 5	Use SubVi‟s for Signal Generation, spectral measurements and filtering based Lab View programs.

List of Programs:

1. Basic arithmetic operations

   (Add, mul, div, compound arithmetic, expression node, express formula and formula node)
2. Boolean operations

   (truth table verification of logic gates, Half Adder and Full Adder, convert binary to decimal value and Vice-Versa)
3. String operations

   (Length, concatenation, insert string, sub-string, replace string, reverse string, rotate string, etc)
4. Build a VI that generates a 1D array of random numbers and sort the array in descending and ascending order and find the following:

   a) Maximum and min value of array elements

   b) Size of the array

   c) Sum and product of array elements

   d) Rotate array by 1position

   e) Split the array after 2elements

5. Generate Fibonacci series for N iteration (use for "loop)
6. Create a VI to implement and, or & not gates(or arithmetic operations) using case structure
7. Create a VI to implement and, or & not gates(or arithmetic operations) using case structure
8. Build VI for generation of various signals and their spectral measurements
9. Build a VI to perform convolution of two given signals
10. Create a VI to perform filtering operations using Filter Express VI

Platform Needed:

LABVIEW Software for Windows/Linux

<table>
<tr><td>Course Title</td><td colspan="5">PCB Design</td><td colspan="3">B. Tech ECE IV Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20SC409</td><td rowspan="2">SC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>1</td><td>-</td><td>2</td><td>2</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To Understand the basics of PCB
• To Create awareness on various softwares to design PCB
• To understand the design procedure of PCB.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the basics of PCB</td></tr>
<tr><td>CO 2</td><td colspan="8">Apply various software’s to design PCB</td></tr>
<tr><td>CO 3</td><td colspan="8">Design some electronic circuits using designing software’s.</td></tr>
<tr><td>CO 4</td><td colspan="8">Design their own PCB projects up to industrial grade.</td></tr>
</table>

UNIT-I

Introduction to PCB: Definition and Need of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation (EDA) tools and comparison.

UNIT-II

Introduction to PCB tools: Introduction of PCB, LIVE WIRE & PCB WIZARD software installation.

Live wire software: Explanation of each and every component of PCB and some basic circuits in Live wire software, Button interfacing with LED circuit, Power circuit, LDR interfacing with LED circuit, Potentiometer interfacing with LED circuit in Livewire software. Button interfacing with motor circuit, 555 timer using LED blinking, fire alarm circuit, police siren circuit, 4026 decade counter circuit in Livewire software.

UNIT-III

PCB WIZARD: Introduction of PCB WIZARD software, Explanation of each and every components and basic PCB circuits in PCB WIZARD software. Button interfacing with LED using PCB designing, LDR interfacing with LED using PCB designing, Potentiometer interfacing with LED using PCB designing. 555 timer using LED blinking designing(Astable and Bistable), fire alarm circuit designing, traffic lights circuit designing, explanation of manual routing and auto routing designing in PCB wizard software.

UNIT-IV

EASYEDA: Introduction of EASYEDA software, Explanation of each and every components and Explanation of basic PCB circuits LED, button, LDR, panic alarm, brightness control, Ac adapter, audio amplifier, common emitter IR sensor circuit, Astable and Bistable multivibrator using 555 timer circuit in EASYEDA software. Traffic lights circuit, motor circuit, explanation of 3D view, manual routing and auto routing designing in EASYEDA software.

UNIT-V

EAGLE: Introduction of EAGLE software, Explanation about circuit components, Basic Circuits explanation, explanation about auto routing and manual routing Astable and bistable circuit designing.

Text Books:

1. Walter Bosshart, "Printed Circuit Boards: Design and Technology", McGraw Hill Education.
2. Michael Dsouza, "PCB Design: Printed Circuit Board", Kindle Edition.

B.Tech V SEM ECE (R20)

<table>
<tr><td>Course Title</td><td colspan="5">Embedded Systems and Internet of Things (IoT)</td><td colspan="3">B. Tech ECE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004501</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- This course imparts knowledge on, introduction to IoT, its complete architecture & internet Protocols involved enabling IoT communication over the network.
- The course also offers an introduction to IoT platforms, end devices, networks and cloud services.
- Using case analysis, assignments, Labs & projects students will acquire skills necessary to identify building blocks of an IoT application.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understanding of the communication protocols in IoT communications
CO 2	Identify issues and design challenges in IoT applications.
CO 3	Describe the topologies and architectures of various processors and IoT
CO 4	Apply appropriate hardware and software components for IoT applications.
CO 5	Develop a models for IoT applications

UNIT-I

Introduction to Embedded systems: Embedded system overview, features and architecture considerations-ROM, RAM, timers, data and address bus, Memory and I/O interfacing concepts, memory mapped I/O. CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture.

UNIT-II

Introduction & Overview of Internet of things: Introduction to The Internet of things today, Vision of internet of things, An IoT architecture outline, Functional blocks of IoT, industrial IoT, Challenges in IOT, Hardware and Software tools required for IoT application development.

Case Study: Simple Link ™ Wi-Fi ® Enabled Electronic Smart Lock.

UNIT-III

Internet/Web and Networking Basics: Introduction to internet & network topologies, TCP/IP protocol, TCP/IP Layers and their relative Protocols, IP addressing(IPV4), IP Address Classification & Subnet, Local IP, Gateway IP and

DNS,TCP & UDP Communication, Overview of MAC Address, Energia Wi-Fi Library API's .

Case Study: Connected microcontrollers essential to automation in buildings.

UNIT-IV

MSP 432 processor: MSP 432 processor features, Architecture, its Booster Packs, Development Environment, Libraries, Fundamental Programming Concepts**,** TM4C123G Launchpad, Sensor hub Boosterpack,CC3220 SF Launch pad.

UNIT-V

Cloud Communication in IOT: IOT device to cloud storage communication Model, need of Cloud services in IOT, Different Cloud storage services, Cloud Data processing and frame format, Introduction to clouds like Temboo, Blynk, Pubnub etc.

IOT Platform and Application development: IoT applications in home, infrastructures, Healthcare, Transport, buildings, security, Industries, and other IoT electronic equipment, Adapting IPV6 for IOT Requirement(overview).

Text Books:

1. Internet of Things: Converging Technologies for Smart Environments and Integrate Ecosystems, Dr. OvidiuVermesan, Dr. Peter Friess, River Publishers.
2. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach", Universities Press.

Reference Books:

1. Embedded Ethernet And Internet Complete (Designing and Programming Small Devices for Networking)by Jan Axelson.
2. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur,AdamDunkels, Morgan Kuffmann.
3. Mazidi, Muhammad Ali, "TI MSP432 ARM Programming for Embedded Systems (ARM books)" Volume 4, MicroDigitalEd, 2016.
4. K.V. Shibu, "Introduction to Embedded systems", Second edition McGrawHill Education.

<table>
<tr><td>Course Title</td><td colspan="5">Communication Systems</td><td colspan="3">B. Tech ECE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004502</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To analyze different modulation and demodulation techniques.
• To analyze various transmitter and receiver functions and circuits.
• To understand the noise in communication</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand various modulation techniques and sources of noise.</td></tr>
<tr><td>CO 2</td><td colspan="8">Apply basic principles to compute various modulation parameters, noise characteristics, entropy, channel capacity.</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze various modulators, demodulators, transmitters, receivers, Inter-symbol Interference and error control techniques.</td></tr>
<tr><td>CO 4</td><td colspan="8">Compare various modulation and demodulation techniques and signaling schemes.</td></tr>
<tr><td>CO 5</td><td colspan="8">Design error control coding techniques</td></tr>
</table>

UNIT-I

Introduction to communication systems: Modulation, its needs and types, Fundamental physical limitations.

Analog Modulation Schemes: AM, DSBSC and SSB- Generation and detection methods, FDM, Phase and frequency modulation, NBFM, WBFM, Multi-tone FM, Transmission band width of FM, direct and indirect generations of FM, Demodulation methods.

UNIT-II

Radio Transmitters and Receivers: Block diagram study of radio broadcast AM and FM transmitters, Super heterodyne AM and FM receivers, Measurement of sensitivity, selectivity, choice of IF, AGC.

Noise: External and internal sources of noise, Noise calculations, Noise equivalent resistant, Noise figure, Noise temperature, Effect of noise in AM and FM modulation system.

UNIT-III

Pulse Modulation: PAM generation and detection, PDM and PPM, Generation and detection. TDM, Comparison of TDM & FDM.

Waveform Coders: PCM system and its bandwidth requirement, Noise in PCM Systems, Quantization noise and SNR, Differential PCM, Delta modulation and Noise in delta modulation, Adaptive delta modulation.

UNIT-IV

Base band data transmission: Introduction, Inter-symbol Interference, Nyquist's Criterion for distortion less binary data, M-ary signaling scheme, Binary Vs M – ary, Eye diagrams.

Digital modulation schemes (Band Pass Data Transmission): Correlator and Matched filter receivers, ASK, FSK (coherent & Non Coherent), PSK, DPSK, Comparison of digital modulation schemes, M-ary signaling schemes- QPSK and QAM-case studies.

UNIT-V

Information theory: Introduction, Unit of information, Entropy, Rate of Information, Joint and conditional entropy, mutual information, channel capacity-Binary symmetric and non symmetric channels, Continuous Gaussian channel (Shannon-Hartley theorem)

Error control coding: Linear block codes- matrix description, Hamming codes, Decoding, Burst and random error correcting codes- Convolutional codes, code tree diagram, state diagram, trellis diagram.

Text Books:

1. Simon Haykin, "Communication Systems", Wileyestern,1978, 4th edition.
2. Sam Shanmugam,, K "Analog & Digital Communication Systems", John Willey & Sons.

Reference Books:

1. R.P. Singh & S.D. Sapre, "Communication Systems, Analog & Digital", Tata McGraw-Hill
2. B.P. Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press, 2nd Edition, 1996.
3. Bernard Sklar, "Digital Communications", Prentice-Hall PTR, 2nd Edition, 2001.
4. Kennedy and Davis, "Electronic communication systems",4thEdition, Mc Graw International edition, 1992.

Course Title	**Antennas and Wave Propagation**					**B. Tech ECE V Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004503	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Mid Exam Duration: 90Min					**End Exam Duration: 3Hrs**			

Course Objectives: The course should enable the students to:

- Be Proficient in the radiation phenomena associated with various types of antennas and understand basic terminology and concepts of antennas along with emphasis on their applications.
- Analyze the electric and magnetic field emission from various basic antennas with mathematical formulation of the analysis.
- Explain radiation mechanism of different types of antennas and their usage in real time field.
- Justify the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define various antenna parameters
CO 2	Describe the radiation mechanisms of various antennas.
CO 3	Analyze characteristics of antenna arrays.
CO 4	Calculate Various parameters of antenna.
CO 5	Analyze the effects of atmosphere on wave propagation.

UNIT-I

Antenna Basics: Introduction, Basic antenna parameters- patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Effective height, Antenna Apertures, Friis transmission formula, Illustrative problems. Fields from oscillating dipole, Antenna temperature, front–to-back ratio, basic Maxwell's equations, retarded potential-Helmholtz Theorem, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Field Components, Radiated power, Radiation Resistance, Beam width, Directivity, Effective Area and Effective Height, Natural current distributions, far fields.

UNIT-II

Antenna Arrays: Point sources- Definition, Patterns, arrays of 2 Isotropic sources. Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, Derivation of their characteristics and comparison, BSA with Non-uniform Amplitude Distributions, Binomial Arrays.

UNIT-III

VHF, UHF AND Microwave Antennas: Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded Dipoles & their characteristics. Helical Antennas, Horn Antennas, Parabolic Reflector, Micro strip Antennas. Antenna Measurements: Introduction, Directivity Measurement, Gain Measurements (by comparison, Absolute and 3-Antenna Methods), case study.

UNIT-IV

Wave Propagation-I: Introduction, Characterizations and general classifications, different modes of wave propagation, Ray/ Mode concepts. Ground wave propagation - Introduction, Plane earth reflections, Space and surface waves, wave tilt, curved earth reflections. Space wave propagation-Introduction, field strength variation with distance and height, effect of earth's curvature, absorption, Super refraction, M-curves and duct propagation, scattering phenomena, tropospheric propagation, fading and path loss calculations.

UNIT-V

Wave Propagation-II: Sky wave propagation- Introduction, structure of Ionosphere, refraction and reflection of sky waves by Ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, Multi-HOP propagation, Energy loss in Ionosphere, Summary of Wave Characteristics in different frequency ranges.

Text Books:

1. John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and wave propagation", TMH, New Delhi, 4th Edition, (Special Indian Edition), 2010
2. E.C. Jordan and. Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2nd Edition, 2000.
3. C.A. Balanis, "Antenna Theory" John Wiley & Sons, 2nd Edition, 2001.

Reference Books:

1. K.D. Prasad, "Antennas and Wave Propagation", Satya Prakashan, Tech India Publications, New Delhi, 2001.
2. F.E. Terman, "Electronic and Radio Engineering," McGraw-Hill, 4 th Edition, 1955.
3. Warren L. Stutzman, Gary A. Thiele, "Antenna Theory and Design", John Wiley & Sons, 3rd Edition.
4. Richard C. Johnson, "Antenna Engineering Handbook", McGraw-Hill, 1993.

<table>
<tr><td>Course Title</td><td colspan="4">Electronic Measurements and Instrumentation</td><td colspan="3">B. Tech ECE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004504</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To know various measuring systems and their functionality.
- To understand various measurement metrics for performance analysis.
- To explain principles of operation and working of different electronic instruments.
- To familiarize the characteristics, operations, calibrations and applications of the different Oscilloscopes.
- To provide exposure to different sensors and transducers.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the principle of operation of various Analog Instruments, Digital Instruments, CROs, Bridges and transducers.
CO 2	Describe the working f various analog and digital instruments.
CO 3	Compare the various Analog Instruments, Digital Instruments, CROs, Bridges and transducers.
CO 4	Apply the various Analog Instruments, Digital Instruments, CROs, Bridges and transducers in measurements.

UNIT-I

Performance characteristics of Instruments: Static characteristics- Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement. Dynamic Characteristics- Speed of response, Fidelity, Lag and Dynamic error.

Analog Instruments: Transistor Voltmeter, Micro Voltmeter (Chopper type) – DC Differential voltmeter – AC voltmeters – Multi meter -wave analyzers (AF & RF) – Harmonic distortion analyzer- Spectrum analyzer-Applications.

UNIT-II

Digital Instruments: Digital Voltmeters (Ramp, Dual slope, stair case, successive approximation types) Digital multi meter, Universal counter, Digital tachometer, Digital Phase meter.

UNIT-III

Cathode Ray Oscilloscopes: Motion of electron in electronic field and in magnetic field- Block diagram of CRO, CRT, Electrostatic deflection sensitivity – Vertical and Horizontal deflection systems – Principle of operation of dual beam, dual trace, sampling and storage CRO‟s.

UNIT-IV

Bridges: Wheat stone bridge, Kelvin Bridge, Measurement of inductance- Maxwell's bridge, Anderson Bridge. Measurement of capacitance -Schering Bridge, Wien Bridge Errors andprecautions in using bridges- Q meter and measurement methods

UNIT-V

Transducers: Active & passive transducers **,** Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors.

Measurement of physical parameters - Force, Pressure, V e l o c i t y , Humidity, Moisture, Speed, Proximity and Displacement. Data Acquisition Systems.

Text Books:

1. H.S. Kalsi , "Electronic instrumentation", second edition , Tata McGraw Hill, 2004.

2. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", 5th Edition, PHI, 2002.

Reference Books:

1. Ernest O. Doebelin and Dhanesh N Manik, "Measurement Systems", 6th Ed., TMH,2010

2. David A. Bell , "Electronic Instrumentation & Measurements", 2nd Edition , PHI , 2003.

3. Robert A.Witte, "Electronic Test Instruments, Analog and Digital Measurements", 2nd Ed.,Pearson Education,2004.

4. K. Lal Kishore , "Electronic Measurements & Instrumentations", Pearson Education - 2005

<table>
<tr><td>Course Title</td><td colspan="4">Computer Architecture and Organization</td><td colspan="3">B. Tech ECE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004505</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To understand the architecture of a modern computer with its various processing units. Also the Performance measurement of the computer system.
- To understand the memory management system of computer.
- To understand the various instructions, addressing modes.
- To understand the concept of I/O organization.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the architecture of modern computer, different instruction types, concepts of I/O Organization and Memory systems.
CO 2	Analyze the Performance of a computer using performance equation, Instruction Sequencing, Input/output Operations
CO 3	Describe Addressing Modes, Buses memory circuits, Micro programmed Control and Execution of Complete Instruction
CO 4	Compare the buses and memory systems.

UNIT-I

Basic Structure Of Computers: Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, The history of computer development.

Machine Instruction and Programs: Instruction and Instruction Sequencing, Register Transfer Notation, Assembly Language Notation, Basic Instruction Types.

UNIT-II

Central Processing Unit: General registers Organization, Stack Organization, Instruction formats, Addressing Modes, Program Control, RISC, Parallel Processing, Pipelining, Arithmetic Pipeline, and Instruction Pipeline.

Type of Instructions: Arithmetic and Logic Instructions, Branch Instructions, Addressing Modes, Input/output Operations.

UNIT-III

Input / Output Organization: Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access.

Buses: Synchronous Bus, Asynchronous Bus, Interface Circuits, Standard I/O Interface: Peripheral Component Interconnect (PCI) Bus, Universal Serial Bus (USB).

UNIT-IV

The Memory Systems: Basic memory circuits, Memory System Consideration, Read Only Memory: ROM, PROM, EPROM, EEPROM, Flash Memory, Cache Memories: Mapping Functions, INTERLEAVING.

Secondary Storage: Magnetic Hard Disks, Optical Disks,

UNIT-V

Processing Unit: Fundamental Concepts: Register Transfers, Performing an Arithmetic Or Logic Operation, Fetching A Word From Memory, Execution of Complete Instruction, Hardwired Control, Micro programmed Control- Microinstructions, Micro program Sequencing, Wide Branch Addressing Microinstructions with next –Address Field

Text Books:

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky - "Computer Organization", McGraw Hill, 5thEdition2011.

2. John P. Hayes - "Computer Architecture and Organization", McGrawHill,3rdEdition, 2002.

Reference Books:

1. William Stallings - "Computer Organization and Architecture "– Pearson/PHI, Sixth Edition,
2. Andrew S. Tanenbaum - "Structured Computer Organization" PHI/Pearson, 4th Edition2012.
3. Sivaraama Dandamudi - "Fundamentals of Computer Organization and Design", Springer Int.Edition, 2003. J .P. Hayes, "Computer Architecture and Organization", McGraw-H

<table>
<tr><td>Course Title</td><td colspan="5">Optical Communication</td><td colspan="3">B. Tech ECE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004506</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectes:

- To understand the functionality of various components of fiber optical fiber communication system.
- To understand the properties and principles of different types of optical fibers, and losses that occur in fibers.
- To understand the working principle of optical sources (LED and LASER) and power launching schemes.
- To analyze the operation of various optical detectors (PIN & APD) and optical receiver.
- To understand the design of optical systems, WDM and Measurements.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the structures of Optical fibers based on modes, refractive index and fiber materials, principle of Optical Sources and detectors.
CO 2	Describe Transmission Characteristics of optical fibers, Rays & Modes in Optical Fiber, fiber Power Launching, Joints and splicing.
CO 3	Compare the types of optical sources and optical detectors on the basis of construction and principle of operation.
CO 4	Analyze the different kind of losses and dispersions in fibers, parameters in Optical system design.
CO 5	Evaluate various parameters in designing Optical receivers.

UNIT-I

Introduction to Optical fibers: Historical Development, General communication System, Optical Fiber Communication System, Advantages & Applications of Optical Fiber Communication, Ray Theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Rays & Modes in Optical Fiber, V-Number, Mode coupling, Cylindrical Fiber- Step Index & Graded Index Fibers, Single & Multi mode fibers, Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Simple problems.

UNIT-II

Fiber Materials: Glass fibers, Halide glass fibers, Active glass fibers, Chalgenide glass fibers, Plastic optical fibers, Mechanical Properties of Fibers, Fiber Optic Cables.

Transmission Characteristics of optical fibers: Attenuation, Losses in optical fiber- Absorption Losses, Scattering Losses, Bending Losses, Core and Cladding losses, Dispersion- Chromatic dispersion, Material dispersion, Wave guide dispersion, Polarization Mode Dispersion, Intermodal dispersion, Fiber Birefringence

UNIT-III

Optical Sources: Introduction, Light Emitting Diodes (LEDs), LED Structures-Surface Emitting LED & Edge emitting LED, Light Source Materials, Quantum efficiency and LED Power, Modulation of LED, Advantages of LED, LASER Diodes, Laser action processes, Laser Diode Modes and Threshold Conditions, Laser Diode Rate Equations, External Quantum Efficiency, Resonant Frequencies, Advantages of LASER Diode, Comparison of LED & LASER Diodes.

Photo Detectors: Requirements of photo detectors, PIN photo detector, Avalanche photo diode (APD), Detector response time, Structures for InGaAs APDs, Temperature effect on avalanche gain, comparisons of photo detectors, case studies.

UNIT-IV

Power launching and Coupling: Introduction, Source to Fiber Power Launching, Source output pattern, power coupling calculation, power launching versus wavelength, Equilibrium Numerical Aperture, Lensing schemes for Coupling Improvement, Non imaging microsphere, Laser diode to fiber coupling, LED coupling to single mode fibers.

Fiber to fiber Joints-Mechanical misalignment, Fiber Splicing-Splicing techniques, splicing single mode fibers, Optical Fiber Connectors-Connector types, Single mode fiber connectors- Connector return losses, Passive components-2 x 2 fiber coupler, Star couplers.

UNIT-V

Optical receiver operation: Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Optical system design-Point to point links, system considerations, Link Power budget, Rise time budget, Transmission distance, Concept of WDM-Operational principle, Types, Fiber grating filters. Measurements-Optical Time domain Reflectometer (OTDR), Attenuation Measurements-Cut back technique & Insertion loss method, Dispersion Measurements, EYE Patterns.

Text Books:

1. Gerd Keiser, "Optical fiber communications", McGraw Hill International Edition, 4th Edition, 2010.
2. John M. Senior, "Optical fiber communications", Prentice Hall of India, 3rd Edition, 2010.

Reference Books:

1. Max Ming-Kang Liu, "Principles and Applications of Optical Communications", TMH, 2010.
2. S. C. Gupta, "Text book on optical fiber communication and its applications", Prentice Hall of India, 2005.
3. Satish Kumar, "Fundamentals of Optical Fiber communications", Prentice Hall of India, 2009.

<table>
<tr><td>Course Title</td><td colspan="5">Disaster Management</td><td colspan="3">B.Tech CE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE101</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
To make the student to provide basic conceptual understanding of disasters and its relationships with planning management.
To make the student to gain an understanding of the scope and extent to which natural and manmade disasters influence vulnerability profile of India.
To make the student able to relate disasters impact on social, economic and political environment.
To make the students to understand approaches of Disaster Risk Reduction and the relationship between vulnerability, disasters, disaster prevention and risk reduction.
To make the student able to enhance awareness of Disaster Risk Management and build skills to respond at disasters.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
</table>

CO 1	Define and describe the terminology used within disaster planning and Management.
CO 2	Understand the scope, extent, and complexity of natural and man-made disasters.
CO 3	Justify the knowledge gained from disaster impacts on health, psycho-social issues and demographic aspects
CO 4	Discuss effective means to plan, mitigate, respond, and recover from disasters and emergencies, natural and man-made
CO 5	Understand the problems associated with government collaboration and assistance to state and local governments and non-governmental organizations.

UNIT-I

Introduction

Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation.

UNIT – II

Disasters

Disasters classification; natural disasters: floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.; manmade disasters: industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.; hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT – III

Disaster Impacts

Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT – IV

Disaster Risk Reduction (DRR)

Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); sustainable and environmental friendly recovery; reconstruction and development methods.

UNIT – V

Environment and Development

Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni and Madhavi Ariyabandu, "Disaster Risk Reduction in South Asia", PHI Learning Pvt. Ltd., Delhi.
2. B. K. Singh, "Handbook of Disaster Management: Techniques and Guidelines", Rajat Publications, Delhi.
3. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC.
4. Inter-Agency Standing Committee (IASC) (Feb. 2007) IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Reference Books:

1. G. K. Ghosh, "Disaster Management", APH Publishing Corporation, New Delhi.
2. http://ndma.gov.in/ (Home page of National Disaster Management Authority.
3. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
4. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.

<table>
<tr><td>Course Title</td><td colspan="5">Basics of Civil Engineering</td><td colspan="3">B.Tech CE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE102</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
To include the essentials of civil engineering field to the students of all branches of Engineering
To provide the students an illustration of the significance of the civil engineering profession in satisfying social needs.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
</table>

CO 1	Illustrate the fundamental aspects of Civil Engineering.
CO 2	List the components of various types of buildings.
CO 3	Explain the concepts of planning and able to read a building plan.
CO 4	Illustrate the setting out of a building and acquire knowledge on building area items.
CO 5	Discuss about various building materials used for construction.

UNIT-I
General introduction to Civil Engineering
Various disciplines of civil engineering, Relevance of civil engineering in the overall infrastructural development of the country. Introduction to types of buildings as per NBC, selection of sites for buildings.

UNIT – II
Building Components
Components of residential buildings and their functions; Introduction to industrial buildings – office/factory/software development office/power house/electronic equipment service centre.

UNIT – III
Building planning
Introduction to planning of residential buildings- site plan, orientation of a building, open space requirement, position of doors and windows, size of rooms; preparation of a scaled sketch of the plan of a single storeyed residential building in a given site plan.

UNIT – IV
Building area items
Introduction to the various building area items – computation of plinth area / built up area, floor area / carpet area – for a single storeyed building; setting out of a building.

UNIT – V
Building construction
Foundations; Bearing capacity of soil (definition only) - Functions of foundations, Types - shallow and deep (sketches only)
Brick masonry – header and stretcher bond, English bonds – Elevation and Plan (one brick thick walls only)
Roofs – functions, types, roofing materials
Floors – functions, types; flooring materials

Paints and Painting – Purpose, types

Text Books:

1. Gopi, S., “Basic Civil Engineering”, Pearson Publishers
2. S.S Bhavikatti, “Basics civil engineering”, New international publishers
3. Rangwala, S.C and Dalal, K. B., “Building Construction”, Charotar Publishing house
4. Rangwala, S.C., “Essentials of Civil Engineering”, Charotar Publishing

Reference Books:

1. Mckay, W.B. and McKay, J. K., “Building Construction Volumes 1 to 4”, Person India Education Services
2. Minu, S., “Basic Civil Engineering”, Karunya Publication
3. Chudley, R., “Construction Technology, Vol. I to IV”, Longman Group, England
4. Kandya, A. A., “Elements of Civil Engineering”, Charotar Publishing house.

<table>
<tr><td>Course Title</td><td colspan="5">Building Materials</td><td colspan="3">B.Tech CE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE103</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
The importance and fundamental knowledge of building materials such as stones and aggregates its properties for better construction.
The laboratory, field tests conducted on Bricks and Cement to identify better construction materials with strength & durability.
The ability to understand the properties of Lime and Timber.
Understand various Masonry works used in the construction field.
To study the Modern Engineering materials used in construction.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
</table>

CO 1	Aware of natural and manufactured aggregates and the importance of physical properties of aggregates used for building construction.
CO 2	Identify various properties of bricks and steel used in construction of structures.
CO 3	Select appropriate timber and cement materials for different types of constructions.
CO 4	Choose suitable masonry works for modern construction to enhance the elegance and performance.
CO 5	Aware of different modern materials in construction.

UNIT-I

Stones and Aggregates

Properties of building stones – Classification of stones – Stone quarrying, precautions in blasting – Dressing of stone, Fine aggregate: Natural and manufactured – Sieve analysis – Different tests on fine aggregate, Coarse aggregate: Natural and manufactured – Importance of size, shape and texture.

UNIT – II

Bricks

Composition – Types of bricks – Manufacturing process of bricks – Test on bricks – Standard requirements and grades.

Steel

Types and grades of steel, tests on steel, applications.

UNIT – III

Cement

Introduction – Chemical Composition – Types of cement with their specific uses – Grade of cement as per BIS – Engineering properties of cement – Field and Laboratory test of cement as per BIS.

Timber

Types of timber – Uses and application of timber – Defects in timber and wood – Seasoning Wood – Wood products with specific uses

UNIT – IV

Masonry Works

Masonry - Stone Masonry - Rubble Masonry - Brick Masonry - Bond - Types of bonds - English and Flemish bonds - Composite masonry - Concrete Masonry - Reinforced masonry - Types of walls - Types of Partition walls.

UNIT – V

Modern Building Materials

Aluminum – Fiber Reinforced Polymers – Ferro cement – Composite materials – Light Weight Roofing Materials – GI Sheets – Ceramics – Other Modern Materials.

Text Books:

1. Rajput R.K. "Engineering Materials", S. Chand & Company Ltd. New Delhi, Third Edition2009.
2. P C Varghese, "Building Materials", PHI Learning Pvt. Ltd., Delhi.
3. G C Sahu, Joygopal Jena, "Building Materials and Construction", McGraw hill Pvt Ltd 2015.
4. Arthur Lyons De, "Materials for Architects and Builders", Montfort University, Leicester, UK.

Reference Books:

1. S C Rangwala, "Engineering Materials", Charotar Publishing House Pvt. Ltd., Anand, Gujarat.
2. S K Duggal, "Building Materials", New Age International (P) Limited, Publishers, New Delhi.
3. S. C. Rangwala, "Building Construction", Charotar Publishing House Pvt. Ltd., Anand, Gujarat.
4. R. Chubby, "Construction Technology – Vol – I & II", Longman UK

ourse Title	Modern Control Theory					B. Tech. EEE Open Elective - 1		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE201	**Open Elective (OEC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 1Hr30M						**End Exam Duration: 3Hrs**		

Course Objectives: Students are able to learn the State Space, Describing function, phase plane and stability analysis including controllability and observability.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Understand the concept of State Space Techniques
CO 2	Analyze the stability of linear and nonlinear Systems
CO 3	Construct the state model of Linear Time Invariant systems and Lyapunov functions for nonlinear systems
CO 4	Determine Eigen values state transition matrix and examine the controllability and observability of linear time invariant systems
CO 5	Design state feedback controller and observer

UNIT – I

State variable descriptions: Concepts of state, state variables, state vector, state space model, representation in state variable form, phase variable representation.

UNIT – II

Solution of State Equations: diagonalization –state transition matrix – properties - .solution of state equations of homogeneous and non-homogeneous systems.

UNIT – III

Controllability and Observability: Definition of controllability – controllability tests for continuous linear time invariant systems – Definition of observability – observability tests for continuous linear time invariant systems,

UNIT – IV

Design of Control Systems: Introduction, Pole placement by state feedback, Full order and reduced order observers,

UNIT – V

Stability: Introduction, equilibrium points – stability concepts and definitions – stability in the sense of Lyapunov - stability of linear system – methods of constructing Lyapunov functions For non-linear system : Krasovskii's method – Variable gradient method.

Text Books

1. Modern Control System Theory by M. Gopal, New Age International Publishers, 2nd edition, 1996.
2. Control System Engineering by I. J. Nagarath and M. Gopal, New Age International (P) Ltd.

Reference Books

1. Modern Control Engineering by K. Ogata, Prentice Hall of India, 3rd Edition, 1998.
2. Systems and Control by Stainslaw, H. Zak, Oxford Press, 2003.
3. Digital Control and State Variable Methods by M. Gopal, TMH, 1997.

<table>
<tr><td>Course Title</td><td colspan="5">Programming Fundamentals for Numerical Computations</td><td colspan="3">B. Tech. EEE
Open Elective - I</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE202</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1Hr30M</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The main objective of the course is to make the students familiar with scripts, functions, control flow and plotting and use them to solve various engineering problems.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand basic features, arrays and symbolic algebra.</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze various control flow structures, interpolation and curve fitting</td></tr>
<tr><td>CO 3</td><td colspan="8">Solve linear equations, Polynomials</td></tr>
<tr><td>CO 4</td><td colspan="8">Plot two-dimensional and three-dimensional graphics</td></tr>
</table>

UNIT-I

Basics Fundamental Features: Basic features, script M-files, code cells, arrays creation, addressing and array operations; multi dimensional arrays.

UNIT-II

Control Flow: Arithmetic & Logical operators, control flow - if, if-else, for, while, switch case constructions and functions.

UNIT-III

Mathematical Operations: Matrix algebra and solutions to systems of linear equations, polynomials, Numerical integration, numerical differentiation

UNIT-IV

Graphics & Numerical techniques: Two-dimensional graphics, basics of three-dimensional graphics, interpolation, curve fitting.

UNIT-V

Symbolic Mathematics: Symbolic algebra, equation solving, differentiation and integration.

Text Books

1. Hanselman and Littlefield, "Mastering MATLAB 7", Pearson Education Etter,
2. Kuncickly, Hull, "Introduction to MATLAB 6", Pearson Education.

<table>
<tr><td>Course Title</td><td colspan="4">Introduction to Hybrid and Electrical Vehicles</td><td colspan="3">B.Tech ME V Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE301</td><td rowspan="2">OEC-I</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:
. The objectives of this course are to

- Provide good foundation on hybrid and electrical vehicles.
- To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles.
- Familiarize energy storage systems for electrical and hybrid transportation.
- To design and develop basic schemes of electric vehicles and hybrid electric vehicles.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Use working of hybrid and electric vehicles.
CO 2	Choose a suitable drive scheme for developing an hybrid and electric vehicles depending on resources.
CO 3	Develop the electric propulsion UNIT and its control for application of electric vehicles
CO 4	Choose proper energy storage systems for vehicle applications.
CO 5	Design and develop basic schemes of electric vehicles and hybrid electric vehicles.

UNIT – I

Electric Vehicle Propulsion And Energy Sources

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge , specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

UNIT – II

Electric Vehicle Power Plant And Drives

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives-PWM, current control method. Switch reluctance machine drives - voltage control, current control.

UNIT – III

Hybrid And Electric Drive Trains

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies.Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

UNIT - IV

Electric And Hybrid Vehicles - Case Studies

Parallel hybrid, series hybrid -charge sustaining, charge depleting.Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev.Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

UNIT – V

Electric And Hybrid Vehicle Design

Introduction to hybrid vehicle design.Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem.Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2/e, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, AvestaGoodarzi, Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach, illustrated edition, John Wiley & Sons, 2014.
3. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

Reference Books:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
2. John G. Hayes, G. AbasGoodarzi, Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, 1/e, Wiley-Blackwell, 2018

<table>
<tr><th>Course Title</th><th colspan="5">Rapid Prototyping</th><th colspan="3">B. Tech. ME V Sem</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">20OE302</td><td rowspan="2">OEC-I</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 90 Minutes</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

. The objectives of this course are to

- Familiarize techniques for processing of CAD models for rapid prototyping.
- Explain fundamentals of rapid prototyping techniques.
- Demonstrate appropriate tooling for rapid prototyping process.
- Focus Rapid prototyping techniques for reverse engineering.

Train Various Pre – Processing, Processing and Post Processing errors in RP Processes

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Use techniques for processing of CAD models for rapid prototyping.
CO 2	Implement fundamentals of rapid prototyping techniques.
CO 3	Choose appropriate tooling for rapid prototyping process.
CO 4	Create rapid prototyping techniques for reverse engineering.
CO 5	Identify Various Pre – Processing, Processing and Post Processing errors in RP processes.

UNIT - I

Introduction to RP Introduction

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

RP Software: Need for RP software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, SolidView, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

UNIT - II

Solid and Liquid Based RP Systems

Solid and Liquid Based RP Systems: Stereolithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications. Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications. Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications. Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

UNIT - III

Powder Based RP Systems Powder Based RP Systems

Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.

Other RP Systems: Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballastic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

UNIT - IV

Rapid Tooling

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

UNIT – V

Errors in RP Processes

Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc.

RP Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Text Books:

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” Fifth Edition, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, Springer, Second Edition, 2010.

Reference Books:

1. Frank W.Liou, “Rapid Prototyping & Engineering Applications”, CRC Press, Taylor & Francis Group, 2011.

<table>
<tr><td>Course Title</td><td colspan="5">Design for Manufacturing and Assembly</td><td colspan="3">B.Tech ME V Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE303</td><td rowspan="2">OEC-I</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

. The objectives of this course are to

- Discuss various factors influencing the manufacturability of components and use of tolerance s in manufacturing
- Explain various considerations in casting, welding, forging and machining processes.
- Demonstrate on the design factors dependent on the assembly methods.
- Teach the principles and rules of design for assembly.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Apply the importance of Design for Manufacturing and Assembly.
CO 2	Examine the form design factors with the help of Case study.
CO 3	Evaluate how the factor of redesign affects the product life cycle.
CO 4	Make use of DFA methods proposed by Boothroyd and Dewhurst.
CO 5	Analyse the importance of Design for Manufacturing and Assembly.

UNIT - I

Introduction to DFM

Significance of design, qualities of a designer and Design factors, Systematic working plan, The engineering problem to be solved, The basic design, Factors influencing choice of materials and the factors influencing manufacturing Process Capability Mean, Median, Variance, Mode, Standard Deviation, Normal Distribution and Process capability metrics, Process Capability, Tolerances-symbols and definition, Tolerances relevant to manufacturing, assembly and material condition, Tolerance stack- effects on assembly with examples, Methods of eliminating tolerance stack with examples.

UNIT - II

Form Design-Casting and Welding

Influence of loading, Materials, Production methods on form design, Casting considerations, Grey iron castings, Steel castings, Aluminum Casting Requirements and rules for casting, Form design of pressure die castings, Welding considerations welding Processes, Requirements and rules for welding, Redesign of components for casting-pattern-mould-Parting Line, Redesign of components for welding, Case studies in form design-simple problems in form design

UNIT – III

Form Design-Forging and Machining

Forging considerations hammer forging drop forging, Requirements and rules for forging, Choice between casting, forging and welding, Machining considerations Drills, Milling-Keyways, Dwells and Dwelling Procedure Countersunk Head screws Requirements and rules for Machining considerations and Reduction of machined areas Redesign of components for Forging, Redesign of components for Machining, Simplification by separation and Simplification by amalgamation, Case studies.

UNIT - IV

Introduction to DFA

DFA, Introduction, Distinction between assembly methods and processes, Factors Determining assembly methods and processes, Success and failure-Causes of failure, Product Design factors independent of methods and processes , Introduction-Number of operations in the product, Assembly Precedence, Standardization, Design factors dependent on Assembly methods , Introduction-Single Station Assembly Line Assembly, Hybrid Systems, Manual Assembly lines, Flexible Assembly lines, Design factors dependent on Assembly processes, Factors Influencing Production rate to Facility Ratio- Parts Presentation, Manual Assembly, Dedicated Assembly, Transportation, Separation and Orientation-Flexible Assembly, Gripping, Transferring, Part Insertion, Failures and Error Recovery.

UNIT - V

Design For Assembly Methods

Approaches to design for assembly and Introduction, Approaches based on design principles and rules, Example DFA method using Design Principles, DFA Systems employing Quantitative evaluation procedures, IPA Stuttgart Method, DFA Methods employing a Knowledge based approach, Knowledge representation Computer Aided DFA methods, Part model, Feature, Processing. Assembly measures like Qualitative and Quantitative measures, Boothroyd and Dewhurst DFA method. Redesign of a simple product , Small consumer product and Fastener solution redesign using symmetry, Case Studies Designing of a disposal valve, Design of a lever-arch file mechanism.

Text Books:

1. Harry Peck., “Design for Manufacture”, Pittman Publications, 1983.
2. Alan Redford and chal, “Design for Assembly-Principles and Procedures”, McGraw Hill International Europe, London, 1994.

Reference Books:

1. RobertMatousek, “Engineering Design A Systematic Approach”, Blackie &sons Ltd., 1963.
2. James G.Bralla, “Hand Book of Product design for Manufacturing”, McGraw Hill Co., 1986.
3. Swift, K.G., “Knowledge Based Design for Manufacture”, Kogan Page Ltd., 1987

Course Title	Energy Systems in Engineering					B.Tech ME V Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE304	OEC-I	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	--	3	40	60	100
Mid Exam Duration: 90 Minutes						End Exam Duration: 3Hrs		

Course Objectives:

. The students completing this course are expected:

- Familiarize the sources of energy, power plant economics and environmental aspects.
- Outline the working components of different power plant.
- Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations.
- Impart types of nuclear power plants, and outline working principle and advantages and hazards.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe working components of a steam power plant.
CO 2	Understand the various elements of hydroelectric power plant and their types.
CO 3	Illustrate the working mechanism of Nuclear and Gas turbine power plants.
CO 4	Summarize types of renewable energy sources and their working principle.
CO 5	Analize power plant economics, and environmental aspects.

UNIT – I

Introduction to different Sources of Energy.

STEAM POWER PLANT: Layout of Modern Steam Power Plant, working of different circuits-selection of site- Coal Storage- Classification of coal handling and Ash handling systems.

UNIT – II

HYDRO ELECTRIC POWER PLANT: Selection of Site for Hydro Electric Power Plant – Hydrological cycle – Hydrographs - flow duration curve - mass curve – classification of dams, spill ways and surge tanks.

HYDRO PROJECTS AND PLANT: Classification of Hydro Electric Power Plants – Typical layout – plant auxiliaries – plant operation - pumped storage plants.

UNIT – III

NUCLEAR POWER PLANT: Nuclear fuel – breeding and fertile materials – Nuclear reactor –reactor operation.

TYPES OF REACTORS: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast Breeder Reactor, Homogeneous Reactor and Gas Cooled Reactor - Radiation hazards and shielding –radioactive waste disposal.

GAS TURBINE POWER PLANT: Introduction – Plant Layout – Classification – Working of Simple Gas Turbine Power Plant– Constant pressure and constant volume Gas Turbine Power Plants –Combination of GasTurbine Cycles.

UNIT- IV

POWER FROM NON-CONVENTIONAL SOURCES: Utilization of Solar-Collectors-Principle
of Working, Wind Energy– types – HAWT, VAWT -Tidal Energy.

Direct energy conversion: Solar energy, Fuel cells, MHD generation.

UNIT – V

POWER PLANT ECONOMICS: Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor, utilization factor, Plant capacity factor and plant use factor - Types of loads -Load curve and load duration curve - general arrangement of power distribution

Different types of tariff for Electrical energy –Cost of generation and fixed cost, semi fixed cost, running cost, depreciation methods, and straight line methods Simple problems.

Text Books:

1. P.K. Nag, Power Plant Engineering, 3/e, TMH, 2013.
2. Arora and S. Domkundwar, A course in Power Plant Engineering, DhanpatRai& Co (P) Ltd, 2014

Reference Books:

1. Rajput, A Text Book of Power Plant Engineering, 4/e, Laxmi Publications, 2012.
2. Ramalingam, Power plant Engineering, Scietech Publishers, 2013
3. P.C. Sharma, Power Plant Engineering, S.K. Kataria Publications, 2012

<table>
<tr><th>Course Title</th><th colspan="5">Smart Materials</th><th colspan="3">B.Tech ME V Sem</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
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<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

. The objectives of this course are to

- Introduce the students with HBLS and LBHS smart materials.
- Expose the students in smart systems development and uses.
- Understand the working principle of smart actuators and smart sensors.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Analyse the role of smart materials in development of intelligent systems and adaptive structures.
CO 2	Compare polycrystalline and single crystal piezoelectric materials
CO 3	Identify the influence of stress on characteristic temperatures in SMA and EAP
CO4	Evaluate the role of smart materials in development of intelligent systems and adaptive structures.
CO 5	Develop of various sensors.

UNIT - I

Introduction to Smart Materials

Introduction to Smart Materials: What is Intelligence? Artificial intelligence Vs. embedded Intelligence, Definition of smart material, need for smart materials, classifications of smart systems, components of a smart systems, smart system applications, the role of Smart Materials in developing Intelligent Systems and Adaptive Structures.

UNIT - II

High bandwidth - Low strain generating (HBLS) Smart Materials

Piezoelectric Materials – constitutive relationship, electromechanical coupling coefficients, piezoelectric constants, piezoceramic materials, variation of coupling coefficients in hard and soft piezoceramics, polycrystalline vs single crystal piezoelectric materials, polyvinyldene fluoride, piezoelectric composites.

Magnetostrictive Materials – constitutive relationship, magneto-mechanical coupling coefficients, Joule Effect, Villari Effect, Matteuci Effect, Wiedemann effect, Giant magnetostriction in Terfenol-D, Terfenol-D particulate composites, Galfenol and Metglas materials.

UNIT - III

Low bandwidth - High strain generating (LBHS) materials

Low bandwidth - High strain generating (LBHS) materials: Shape Memory Alloys (SMA) – Introduction, Phenomenology, Influence of stress on characteristic temperatures, Modelling of shape memory effect. Vibration control through shape memory alloys. Design considerations, multiplexing embedded NiTiNOL actuators. Electro-active Polymers (EAP)- Introduction, Phenomenology, Influence of stress on characteristic temperatures.

UNIT - IV

Smart actuators

Based on HBLS smart materials: Piezoelectric Actuators – Induced Strain actuation model, Unimorph and Bimorph Actuators, Actuators embedded in composite laminate, Impedance matching in actuator design, Feedback Control, Pulse Drive, Resonance Drive. Magnetostrictive Actuators – Magnetostrictive Mini Actuators, Thermal instabilities, Discretely distributed actuation, Manetostrictive Composites.

Based on LBHS Smart Materials - Shape Memory Alloy based actuators for Shape Control, Electro-active Polymers for Work-Volume Generation.

UNIT - V

Smart sensors:

Sensors based on HBLS Smart Materials - Piezoelectric Sensors Magnetostrictive Sensors Techniques of Self Sensing MEMS Sensors.

Sensors based on LBHS Smart Materials - EAP based sensors, SMA based encoders, Optical Fibre based Sensing.

Text Books:

1. M.V. Gandhi, B.D. Thompson" Smart Materials and Structures" Springer Science & Business Media, 31-May-1992.

Reference Books:

1. Brian Culshaw, Smart Structures and Materials, Artech House, 2000.
2. Gauenzi, P., Smart Structures, Wiley, 2009.

<table>
<tr><td>Course Title</td><td colspan="5">Data Structures
(Open Elective Course I)</td><td colspan="3">B.Tech V Sem (R20) CSE</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
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<tr><td>20OE501</td><td>OEC</td><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
● To develop skills and analyze linear and nonlinear data structures.
● To understand basic concepts about linked lists, stacks, queues.
● To study algorithms as they apply to trees and graphs.
● To study in detail about sorting.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the variety of abstract data types and data structures.</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze data structures such as linked list, Stacks and Queues.</td></tr>
<tr><td>CO 3</td><td colspan="8">Apply and analyze tree traversal algorithms and graph traversal algorithms.</td></tr>
<tr><td>CO 4</td><td colspan="8">Organize data in order using various sorting algorithms.</td></tr>
</table>

UNIT - I

Introduction: Data structures, Primitive & Non Primitive data structures, Linear & Non Linear data structures, **Linear Lists:** Definition, **Arrays:** Definition, **Linked Lists:** Single Linked List-Definition, Insertion and Deletion operations**,** Doubly Linked List-Definition, Insertion and Deletion operations. **Stacks:** Definition, Array & Linked representations, Operations, Applications.

UNIT – II

Queues: Definition, Array & Linked representations, Operations, Circular Queues & Dequeues.

Trees: Basic terminology, **Binary Trees** - Definition, Properties, Representation, Complete and Full Binary Tree, **Tree Traversal Algorithm:** Inorder, Preorder and Postorder.

UNIT – III

Binary Search Tree (BST): Definition, Operations & Implementations, Indexed

BST.

Balanced Search Trees: AVL trees, Red-Black trees & Splay trees.

UNIT - IV

Graphs: Terminology, Representations, **Graph Traversal:** Depth First Search (DFS), Breadth First Search (BFS), Applications of graphs.

UNIT - V

Sorting: Selection, Insertion, Bubble, Heap, Quick Sort, Merge Sort.

Searching: Linear and Binary search.

Hashing: Introduction, Hash Table representation, Hash Functions.

Text Books:

1. An Introduction to Data Structures with applications, Jean Paul Trembley and Paul G.Sorenson, McGraw Hill.
2. Fundamentals of Data Structures in C, Horowitz, Sahni, Anderson Freed, Universities press.
3. Data Structures using C++, Varsha H.Patil, Oxford University Press.
4. Data Structures, Seymour Lipschutz, Schaum's Outlines, McGraw Hill.
5. Data Structures and Algorithms, G.A.V.Pai, Tata McGraw Hill.

Reference Books:

1. Data Structures, Algorithms and Applications in C++, AnandaRao Akepogu and Radhika Raju Palagiri, Pearson Education.
2. Data Structures and Algorithms in C++, S.Sahni, University Press (India) Private Limited, Second Edition.
3. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

<table>
<tr><td>Course Title</td><td colspan="5">Database Management Systems
(Open Elective Course – I)</td><td colspan="3">B.Tech V Sem (R20) CSE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
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<tr><td colspan="6">Mid Exam Duration: 90 Minutes</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To study the physical and logical database designs, database modeling, relational hierarchical, and network models.
- To understand and use data manipulation language to query, update, and managing the database.
- To develop an understanding of essential DBMS concepts such as: database secur integrity and concurrency.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	To understand the basic concepts and the application of Database systems.
CO 2	To understand the basics of SQL and construct queries using SQL.
CO 3	To understand the Relational Database design principles.
CO 4	To apply various Normalization techniques for database design improvement.
CO 5	To apply concurrency control and recovery techniques during transactionexecution.

UNIT-I

Introduction - Database-System Applications, View of Data, Database languages, Database architecture, Database Users and Administrators.

E-R Model - The Entity Relationship Model, Constraints, Entity Relationship Diagrams, and Extended E-R features.

UNIT-II

Relational Model - Structure of Relational Databases, Database Schema, Keys, Query Languages, Fundamental Relational Algebra Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations, Modification of Database.

UNIT-III

Introduction to SQL - Data Definition, Basic Structure of SQL Queries, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Complex queries, views, Modification of the Database. **Advanced SQL -**Integrity Constraints, Dynamic SQL, Functions and Procedures.

Other Relational Query Languages - Tuple Relational Calculus, Domain Relational calculus.

UNIT-IV

Normal Forms – Atomic domain and First Normal Form, Keys and Functional Dependencies, Second Normal Form, BCNF, BCNF and Dependency Preservation, Third Normal Form, Lossless Decomposition, Dependency- preserving, Multi valued Dependencies, Fourth Normal Form, Join Dependencies, Fifth Normal Form, and Inclusion dependencies.

UNIT-V

Transactions -Transaction Concept, Transaction State, Implementation of Transaction Atomicity and Durability, Concurrent Executions, Serializability.

Concurrency Control -Lock-Based Protocols, Timestamp-Based Protocols. **Recovery System -** Failure Classification, Storage, Recovery and Atomicity, Log based recovery.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, ”Database system Concepts”, 5thEdition, McGrawhill.

2. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 3rd Edition, 2003

3. C.J.Date, “Introduction to Database”, 8 Th Edition, 2003, Addison-Wesley publication.

4. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States 1st Edition, 2000

Reference Books:

1. Raghurama Krishnan, Johannes Gehrke, Data base Management Systems.3rd Edition, Tata McGrawHill.
2. Peter Rob, Ananda Rao and Carlos Corone, Database Management Systems, Cengage Learning, 1st Edition, 2011
3. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management,6th Edition,2012.
4. S.K.Singh, “Database Systems Concepts, Design and Applications”, First Edition, Pearson Education, 2006.

<table>
<tr><td>Course Title</td><td colspan="4">DATA STRUCTURES
(Open Elective Course – I)</td><td colspan="3">B.Tech. V Sem (R20UG) AI&ML</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
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<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To develop skills and analyze linear and nonlinear data structures.
- To understand basic concepts about linked lists, stacks, queues.
- To study algorithms as they apply to trees and graphs.
- To study in detail about sorting.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Understand the variety of abstract data types and data structures.
CO2	Analyze data structures such as linked list, Stacks and Queues.
CO3	Apply and analyze tree traversal algorithms and graph traversal algorithms.
CO4	Organize data in order using various sorting algorithms.

UNIT - I

Introduction: Data structures, Primitive & Non Primitive data structures, Linear & Non Linear data structures, **Linear Lists:** Definition, **Arrays:** Definition, **Linked Lists:** SingleLinked List-Definition, Insertion and Deletion operations**,** Doubly Linked List- Definition, Insertion and Deletion operations. **Stacks:** Definition, Array & Linked representations, Operations, Applications.

UNIT – II

Queues: Definition, Array & Linked representations, Operations, Circular Queues &Dequeues.
Trees: Basic terminology, **Binary Trees** - Definition, Properties, Representation, Completeand Full Binary Tree, **Tree Traversal Algorithm:** In order, Preorder and Post order.

UNIT – III

Binary Search Tree (BST): Definition, Operations& Implementations, Indexed BST.
Balanced Search Trees: AVL trees, Red-Black trees & Splay trees.

UNIT - IV

Graphs: Terminology, Representations, **Graph Traversal:** Depth First Search (DFS),Breadth First Search (BFS), Applications of graphs.

UNIT - V

Sorting: Selection, Insertion, Bubble, Heap, Quick Sort, Merge Sort.
Searching: Linear and Binary search.

Hashing: Introduction, Hash Table representation, Hash Functions.

Text Books:

1. An Introduction to Data Structures with applications, Jean Paul Trembley and Paul G.Sorenson, McGraw Hill.
2. Fundamentals of Data Structures in C, Horowitz, Sahni, Anderson Freed, Universitiespress.
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4. Data Structures, Seymour Lipschutz, Schaum's Outlines, McGraw Hill.
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Reference Books:

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2. Data Structures and Algorithms in C++, S.Sahni, University Press (India) Private Limited,Second Edition.
3. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

Web links:

1. **https://nptel.ac.in/courses/106102064**
2. **https://nptel.ac.in/courses/106103069**

<table>
<tr><td>Course Title</td><td colspan="4">OOP THROUGH C++
(Open Elective Course – I)</td><td colspan="4">B.Tech. V Sem (R20UG) AI&ML</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
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<tr><td colspan="5">Mid Exam Duration: 90 Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To make the students understand the features of object-oriented design and familiarizethem with virtual functions, templates and exception handling.
• To enable the students solve various engineering problems in C++ programming language.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the fundamentals of C++</td></tr>
<tr><td>CO 2</td><td colspan="8">Explain the concept of Tokens and Control Structures.</td></tr>
<tr><td>CO 3</td><td colspan="8">Illustrate the concept of Classes and Objects.</td></tr>
<tr><td>CO 4</td><td colspan="8">Demonstrate the concept of Operator overloading and Inheritance.</td></tr>
<tr><td>CO 5</td><td colspan="8">Understand the concept of Pointers, Virtual functions and Polymorphism</td></tr>
</table>

UNIT – I

Principles of Object-Oriented Programming: Object-Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, Applications of OOP. **Beginning with C++:** Comments, Output Operator, The iostream File, Variables, Input Operator, Cascading of I/O Operators, Structure of C++ program.

UNIT – II

Tokens, Expressions and Control Structures: Tokens, Keywords, Identifiers and Constants, Basic Data Types, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Memory management operators, Manipulators, Control Structures,

Functions in C++: Function Prototyping, Call by reference, Return by reference, Inline Functions, Function Overloading.

UNIT – III

Classes and Objects: Specifying a Class, Defining Member Functions, Memory allocation for objects, Static data members, Static member functions, Arrays of objects, Friendly functions, **Constructors and Destructors:** Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Copy constructor, Dynamic constructor, Destructors.

UNIT – IV

Operator Overloading: Defining operator overloading, Overloading Unary operators, Overloading Binary operators, Overloading Binary operators using Friends.

Inheritance: Introduction, Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual base classes, Abstract classes.

UNIT – V

Pointers, Virtual Functions and Polymorphism: this Pointer, Virtual Functions, Purevirtual functions.

Managing Console I/O Operations: Unformatted I/O operations, Formatted console I/O operations.

Templates: Class Templates, Function Templates, Overloading Template functions, Member function Templates.

Exception Handling: Basics of Exception handling, Exception handling mechanism.

Text Books:

1. The Complete Reference C++, Herbert Schildt, TMH 4th Edition.
2. Learning - Computer Science :A Structured Approach Using C++,2nd Ed., Forouzan, Thomson.
3. Object Oriented Programming With C++, E. Balagurusamy, TMH 6th edition.

Reference Books:

1. Object oriented programming with ANSI and TURBO C++, Ashok N Kamathane,Pearson education.
2. Object oriented programming with C++, Saurav Sahay, Oxford.
3. Learning C++ Programming: From Problem Analysis To Program Design, Malik,Thomson

<table>
<tr><td>Course Title</td><td colspan="5">Employability Skills</td><td colspan="3">B.Tech.
Open Elective-I</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
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<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 90 Min</td><td colspan="3">External Exam Duration: 3 Hrs</td></tr>
</table>

Introduction: Employability skills play an important role in one's career. Professional skills are a person's skill set and ability to perform a certain type of activity or task. Employability skills are a person's ability to interact effectively with co-workers and customers. Hard skills are mainly applicable at the work place. Employability skills are applicable both at workplace and outside the work place. Employability skills complement the hard skills which are occupational requirement of a job. It also complements many other activities even outside the work place. Presently employability skills are increasingly sought out by employers in addition to standard qualification. There are instances of professions where employability skills proved to be more important, on a long term basis than occupational skills. Employability skills refer to behavior, communication, IT Skill, work ethics etc. which makes a person suitable to effectively work in a team. Studies suggest that employability skills are equally important indication of job performance as hard skills. The competency level of the worker increases with the Employability skills and takes him to the next level.

Course Objectives: The main objective of this course is to make the the students

i. Demonstrate effective presentations

ii. Develop and practice self-management skills

iii Assess and improve personal grooming

iv. Create safety awareness including rules and procedures on the work site.

v. Survey the required skills for discussing and resolving problems in the work arena.

Course Outcomes: On success Completion This course ,the students will be able to

CO1	Demonstrate presentations
CO2	Develop and practice self-management skills
CO3	Assess and improve personal grooming
CO4	Create safety awareness including rules and procedures on the work site.
CO5	Survey the required skills for discussing and resolving problems in the work arena.

Syllabus:

UNIT–1 Communication and Teamwork – Communicating effectively, Interpersonal and Intrapersonal skills, A good leader, Leadership behavior, Assertiveness skills.

UNIT -2 Etiquette and Manners – Social and Business. Time Management – Concept, Essentials Tips – prioritization, Kinesics, Adaptability Skills.

UNIT –3 Decision-Making and Problem-Solving Skills: Meaning, Types and Models, Ethical Decision-Making, Problems and Dilemmas in application of these skills. Conflict - Definition, Nature, Types and Causes; Methods of Conflict Resolution, Conflict Management.

UNIT -4 Stress Management: Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress.

UNIT –5 Interview and Presentation Skills: Definition, in-depth perspectives of interviewer and interviewee, preparation – before, during, after, overcoming nervousness, tips for success, Interviewer and Interviewee – Presentation Skills: Types, Content, Audience Analysis, Essential Tips

References:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.

2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

3. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company

Ltd., 2018.

4. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

5. Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012. 6. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

<table>
<tr><td>Course Title</td><td colspan="4">ADVANCED NUMERICAL METHODS (R20)</td><td colspan="4">OPEN ELECTIVE - I</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE602</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hours</td></tr>
</table>

Course Objectives:

1. To solve algebraic, transcendental equations and system of linear equation by various methods.
2. To interpolate and approximate equal and unequal intervals by various formulae.
3. To discuss approximation of numerical differentiation and integration.
4. To solve Ordinary Differential Equations (ODEs) in initial value problems (IVPs) by various methods.
5. To solving ODEs & partial Differential Equations (PDEs) in boundary value problems (BVPs) by various methods.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basic knowledge on solution of system of equations.
CO 2	Use interpolation and approximation to solve engineering problems.
CO 3	Estimate the numerical differentiation and integration.
CO 4	Apply initial value problems for solving first order differential equation.
CO 5	Discuss the boundary value problems in ordinary and partial differential equations.

UNIT I:

Solution of Equations: Solution of algebraic and transcendental equations- Fixed point iteration method, Horner's Method.

Solution of linear system of equations: Gauss Crout's Method, Relaxation method.

UNIT II: Interpolation and Approximation

Finite Differences-Other Difference Operators- To find one or more missing terms. Divide Difference -Newton's divided difference interpolation, Inverse interpolation formula.

UNIT III: Numerical Differentiation and Integration

Numerical differentiation: Finding first and second order derivatives using Newton's formulae. Numerical integration: Newton - Cote's quadrature formulae, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule.

UNIT IV:Initial Value Problems for Ordinary Differential Equations

Single Step methods: Taylor's series method, Euler's method, Fourth order Runge - Kutta method for solving first order equations.

Multi step method: Milne’s predictor - corrector method.

UNIT V: Boundary Value Problems in Ordinary and Partial Differential Equations

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s equation.

Text books:

1. Grewal.B.S., and Grewal.J.S., “Numerical methods in Engineering and Science”, Khanna Publishers, 9th Edition, New Delhi, 2007.
2. Kandasmay,P; Thilagavathy, K; Gunavathi, K, Numerical Methods, S.Chand And Company Ltd, 2007.
3. Applied Numerical Analysis, Pearson Publishers, 7th Edition, Curtis F. Gerald, Patrick O. Wheatley.
4. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 10th edition Reprint 2021.

Reference Books:

1. Chapra.S.C., and Canale.R.P., “Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007.
2. Sankara Rao. K., “Numerical methods for Scientists and Engineers”, Prentice Hall of India Private, 3rd Edition, New Delhi. 2007.
3. Applied Numerical Methods with MATLAB for Engineers and Scientists, Special Indian Edition, Steven C Chapra.
4. Advanced Engineering Mathematics, Neil Opeter V.

Course Title	**ENGINEERING MATERIALS**					**OPEN ELECTIVE- 2**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	BSC	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End lab Exams**	**Total**
		3	**0**	**0**	**3**	40	60	100
					End Exam Duration: 3Hrs			

COURSE OBJECTIVES:

1.This introductory course is aimed to obtain basic exposure to the concepts of crystalline solids, its imperfections and basics of various advance engineering materials finding wide spread application in several industries.
2.Describe the process that is used to produce glass-ceramics.
3.To enlighten the periodic arrangement of atoms in crystals to provide fundamentals related to structural analysis through powder diffraction method.
4.Understanding these material systems are vital for investigating the defects and their nature on these classes of materials.

Course Outcomes: Upon completion of the course, the student will be able to:	
CO1	**Classify** various crystal systems.
CO2	**Explain** the applications of magnetic materials.
CO3	**Analyze** the various metallurgical factors influencing the performance of materials for different Structural engineering applications.
CO4	**Interpret** Lorentz field and Claussius-Mosotti relation in dielectrics.
CO5	**Identify** applications of semiconductors in electronic devices .

Unit –I: Structure of Metals

Introduction-Different types of bonding in solids – Space lattice, Basis, unit cell and lattice parameters – Bravais Lattice – Crystal systems – Packing fraction – Coordination number – Packing fraction of SC, BCC .

Unit– II: Magnetic Materials

Introduction to magnetic materials - Classification of magnetic materials: Dia, Para & Ferro – Domain concept of Ferromagnetism (Qualitative) – Hysteresis loop– Soft and Hard magnetic materials.

Unit– III: Ceramics

Introduction-Types and applications of ceramics- Glasses - Glass-Ceramics - Clay Products - Refractories - Abrasives Cements - Advanced Ceramics - Materials of Importance—Piezoelectric Ceramics

Unit –IV: Dielectric Materials

Introduction to Dielectrics-Electric polarization- Dielectric polarizability, Susceptibility and Dielectric constant-Types of polarizations(Qualitative)–Frequency dependence of polarization-Lorentz(internal) field- Classius-Mosotti equation- Applications of Dielectrics

Unit –V: Electrical Properties of materials

Electrical conduction: - Ohm’s Law - Electrical Conductivity- Electronic and Ionic Conduction - Energy Band Structures in Solids.

Semiconductivity:- Intrinsic Semiconductor - Extrinsic Semiconductor - The Temperature Dependence of Carrier Concentration - Hall Effect - Applications

Text Books:

1. Callister’s Materials Science and Engineering: Wiley, Second Edition, (2018)
2. V. Raghavan, Materials Science and Engineering, Prentice Hall of India, 5th edition (2013).
3. G.E. Dieter, Mechanical Metallurgy, Mc-Graw Hill, 3rd edition (2013).

Reference Books:

1. L. H. Van Vlack, Elements of Materials Science and Engineering, Addison Wesley, 6th edition (1989).
2. I. J. Polmear, Light Alloys: Metallurgy of the Light Metals, Wiley, 3rd edition (1995).
3. V. Raghavan, Physical Metallurgy: Principles and Practice, PHI Learning Private Limited, 2nd edition (2006).

Course Title	Basics of Nanotechnology					B. Tech. (Open elective-I)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE604	**Open Elective**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To make the students acquire an understanding the Nanoscience and Applications
- Student will be able to understand and control matter at the nanoscale leads to a revolution i technology and industry that benefits society.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Acquire knowledge about structure and properties of nano materials
CO 2	Synthesis of nanomaterials by various methods & their applications
CO 3	Identify and understand various top-down and bottom-up approaches for nanomaterial synthesis
CO 4	Correlate properties of nanostructures with their size, shape
CO 5	Appreciate enhanced sensitivity of nanomaterial-based sensors and their novel applications in industry

Unit-I: Introduction

History and Scope, Introduction to nanomaterials, Classification of nanomaterials with suitable examples, Structure of different nanomaterials- Graphenes, CNT's, Fullerene, Properties of nanomaterials-Chemical, Optical, Thermal , Electrical Mechanical.

Learning Outcomes:

At the end of the unit, The students will be able to

- Classification of nanomaterials.
- Identify different structures of nanomaterials.

Unit-2: Synthesis of Nanomaterials

Chemical precipitation and Co-precipitation, Sol-gel synthesis, Electrochemical synthesis, Photochemical synthesis, Evaporation method-Principal & its uses

Learning Outcomes:

At the end of the unit, The students will be able to

- Explain Sol-gel method.
- Discuss electrochemical and chemical methods of synthesis.

Unit-3: Fabrication of Nanomaterials

Top-Down method (Ball milling), Bottom-up method (chemical vapour deposition method, Sol gel method), Self- assembly method, Electric arc method. Nanocomposite fabrication.

Learning Outcomes:

At the end of the unit, The students will be able to

- Explain methods used in fabrication of different nanomaterials

Unit-4: Properties of Nanomaterials
Importance of nano particle, effect of Size on optical, electronic, photonic, mechanical, magnetic and catalytic properties.

Learning Outcomes:
At the end of the unit, The students will be able to
- Explain the importance of nano particles.
- Discuss the effect of size on different properties.

Unit-5: Applications of Nanomaterials

Applications of Nano electronics, Nanooptics, Nano scale chemical & biosensing, biological/ Biomedical applications, Photo voltaic fuel cells-Related applications

Learning Outcomes:
At the end of the unit, The students will be able to
- Know the applications of nanomaterials in different fields.

Textbooks:
1. Text Book of Engineering Chemistry, Shashi Chawla, Dhanapath Rai Publications, New Delhi, 4th Edition, 2011.
2. Textbook of Nanoscience and Nanotechnology in Engineering, Marcel Van de Voorde (Ed.), De Gruyter publications
3. Nanoparticles-Biological activities and nanotechnology, Mindy Adams, NY Research Press
4. Theory and applications of Nano particals, Andrew Green, NY Research Press

Reference Books:
1. Textbook of Nanoscience & Nanotechnology, B.S. Murthy p. Shankar Baldev, University Press-IIM
2. Nanotechnology- A future technology with Visions-BPB Publications
3. Nanotribology, edited by Stephen M. Nsu, Z. Charles Ying, Springer International Edition
4. Introduction to Nanotechnology, Charles P. Poole Jr. Frank J. Owens, Willey Students Editions.

<table>
<tr><td>Course Title</td><td colspan="4">WRITE IT RIGHT</td><td colspan="3">OPEN ELECTIVE - I</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE605</td><td rowspan="2">HUM</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Min</td><td colspan="4">End Exam Duration: 3Hours</td></tr>
<tr><td colspan="9">Course Objectives:
1.To help students get the basics right.
2.To grasp the nature of the writing exercise one has embarked upon
3. To promote effective writing across a whole range of tasks that all of us face on a daily basis</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Utilize effective techniques for writing job applications /course application.</td></tr>
<tr><td>CO 2</td><td colspan="8">Recall the contents to make use of good paragraph writing.</td></tr>
<tr><td>CO 3</td><td colspan="8">Identifying grammatical errors and can make necessary corrections.</td></tr>
<tr><td>CO 4</td><td colspan="8">Demonstrate effective grammatical skills in English.</td></tr>
<tr><td>CO 5</td><td colspan="8">Paraphrase a piece of writing and summarize it easily.</td></tr>
</table>

Syllabus:

Unit 1.

1. The logic of Effective Writing
2. Applying for a course: Applying for a job
3. Writing Correct and Convincing sentences

Unit 2:

1. Generating Ideas through Prewriting
2. Using the Patterns of Paragraph Development:
    a. Narration
    b. Description
    c. Argument
    d. Exposition

Unit 3:

1. Punctuation – list of punctuation marks- their usage for effective written communication
2. Misplaced modifiers
3. Confused words
4. Common mistakes in English
5. The Right Use of the definite article

Unit4:

1. Report writing – types – sample reports
2. e-mail writing
3. Elements of good essay

Unit 5:

1. Precise Writing
2. Developing of an idea/ Expansion
3. Note-making

Text books:

1. Write it Right: A Handbook for Students authored by John Peck and Martin Coyle published by Palgrave Macmillan in New York and Hampshire in 2005.
2. Odyssey- A Guide to Better Writing by William. J. Deborah Lawton Published by Allyn and Bacon.

Reference books

1. Heffron, Jack (ed). The Best Writing on Writing. Story Press, Cincinnati, Ohio, 1994.
2. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
3. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.Oxford Learners Dictionary, 12 th Edition, 2011

<table>
<tr><td>Course Title</td><td colspan="4">Human Capital Management</td><td colspan="3">B.Tech. Open Elective-1</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE606</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 90 Min</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives: The objective of the course is

- TοenablethestudentstounderstandtheHRManagementandsystematvariouslevelsingeneralandincertainspecificindustriesororganizations.
- To help the students focus on and analyze the issues and strategies required to select and develop man power resources.
- To develop relevant skills necessary for application in HR related issues.
- ToEnablethestudentstointegratetheunderstandingofvariousHRconceptsalongwiththedomainconceptinordertotakecorrectbusinessdecisions.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	UnderstandingofrolesandresponsibilitiesofHRdepartmentinindustries.
CO2	Have knowledge to understand job analysis and design jobs.
CO3	Understand job evaluation and estimate HR requirements.
CO4	Able to conduct recruitment & selection process.
CO5	Abletounderstandtrainingmethods.Haveclarityofemployeecompensation

Unit-I

Introduction of HRM: Nature, scope, objectives, Importance and functions, Evolution of the concept of HRM, Human resource management in India; Roles of HR manager, Practice in Industry

Unit-II

Job Analysis &Design: Job Analysis-Meaning, Uses, Process and methods of collecting data for job analysis, Job Description, Job Specifications, Factors affecting Job Design, Techniques of Job Design.

Unit-III

Job Evaluation and Human Resources Planning: Objectives of Job Evaluation; Advantages and Limitations of Job Evaluation, Human Resources Planning (HRP), Need and Benefits of HRP, Process of HRP ,Factors Affecting HRP, Responsibility for HRP.

Unit-IV

Recruitment & Selection: Factors Affecting Recruitment; Sources of Recruitment; Selection Process, Methods of selection-Interviews, Tests, Need for Training and Methods of Training.

Unit-V

Human Resource Development: Meaning, Definition of HRD, objectives, Significance, functions and HRD process.

Text Books:

1. HumanResourceandPersonnelManagement-TextandCases:K.Ashwathappa,TataMcGrawHillEducationPvt.Ltd.
2. PersonnelandHumanResourceManagement-P.SubbaRao,HimalayaPublishing.
3. Human Resource Management – John M Lvancevich (1988) Publish – Irwin Mcgraw Hill.
4. Human Resource Management – Greg L. Stweart John wiley & sons, Inc Publications.
5. Human Resource Development_ Mohammad mohsim (2010) Publisher Vdm Verldg Dr. Muller.

Reference Books:

1. Human Resource Management: P.Jyothi, Publication,OxfordUniversityPress

<table>
<tr><td>Course Title</td><td colspan="5">Communication Systems Lab</td><td colspan="3">B. Tech ECE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004510</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6"></td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• Design and generation of AM, PM, FM,ASK,PSK, QPSK communication techniques.
• Usage of Communications test equipment.</td></tr>
</table>

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Apply the knowledge of Amplitude, Frequency and Pulse Modulation Systems in developing analog Communication systems.
CO 2	Apply the knowledge of TDM, PCM, Delta Modulation, FSK, PSK, DPSK,QPSK in developing Digital Communication systems.
CO 3	Perform measurements like Sensitivity, Selectivity and Fidelity of Communication subsystems and systems.
CO 4	Test equipment to test various communication systems they develop
CO 5	Apply the knowledge of Amplitude, Frequency and Pulse Modulation Systems in developing analog Communication systems.

Part- A: Analog Communication Lab:

1. Amplitude modulation and demodulation.
2. Frequency modulation and demodulation.
3. Characteristics of Mixer.
4. Pre-emphasis & de-emphasis.
5. Pulse Amplitude Modulation and demodulation.
6. Pulse Width Modulation and demodulation.
7. Pulse Position Modulation and demodulation.
8. Radio Receiver measurements – Sensitivity, Selectivity, & Fidelity.

Part- B: Digital Communication Lab:

1. Sampling Theorem – verification.
2. Time division multiplexing.
3. Pulse Code Modulation.
4. Delta modulation.
5. Frequency shift keying - Modulation and Demodulation.
6. Phase shift keying - Modulation and Demodulation.
7. Differential phase shift keying - Modulation and Demodulation.
8. QPSK - Modulation and Demodulation

<table>
<tr><td>Course Title</td><td colspan="4">Embedded Systems and IoT Lab</td><td colspan="4">B. Tech ECE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004511</td><td rowspan="2">ESC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>--</td><td>-</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• This course imparts knowledge on, Arduino Uno, Raspberry pi, MSP430F5529LP and TM4c123G Launch pad.
• The course also offers an introduction to IoT platforms, end devices and cloud services.
• Using these fundamentals learnt in the Lab, students can do projects and will acquire skills necessary to implement an IoT application.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand and Identify issues and design challenges in IoT applications.</td></tr>
<tr><td>CO 2</td><td colspan="8">Select appropriate hardware and software components for IoT applications.</td></tr>
<tr><td>CO 3</td><td colspan="8">Conceptual knowledge will help students to build IoT projects.</td></tr>
<tr><td>CO 4</td><td colspan="8">Understanding of the communication protocols in IoT communications</td></tr>
<tr><td>CO 5</td><td colspan="8">Familiarize with application program interfaces for IoT</td></tr>
</table>

Hardware required: MSP430F5529LP, Arduino Uno, Raspberry pi, TM4C123G Launch pad, Sensor hub Booster pack, CC3220 SF Launch pad.

Software required: Energia v17, Code Composer studio, Arduino Uno, Raspbian, CC3100 SDK, CC3220 SDK & a Serial terminal software**.**

Lab 1

a) Program the MSP430 for Led blink, switch usage, ADC, PWM generation & serial communication.

b) Write a program by using WiFi libraries, to connect your Launchpad with the available Encrypted/non-encrypted WiFi network.

Lab 2

a) Write a program to connect the launch pad with WiFi & print IPAddress, GatewayIP, Subnetmask on Serial Monitor.

b) Write a program to assign a static IP, Gateway & Subnet to a WiFi Connected controller.

Lab 3

a) Design a Client server model between two WiFi modules and establish the communication between the two.

b) Write a program to design client server model based on TCP & UDP communication Protocols.

Lab 4

Design a HTTP based web server to manipulate the GPIO's of WiFi Module and monitor Sensor data connected with WiFi Module.

Lab 5

Use Blynk API's and write a program to control your Launchpad with Mobile Application.

Lab 6

Using temboo credentials connect your launchpad with Yahoo weather to receive weather details in serial terminal.

Lab 7

With the help of Temboo services, generate Code for CC3220SF launchpad and upload it from TI CCS Cloud.

Lab 8

Design a Simple MQTT Based communication model to retrieve sensor data from a cloud Storage.

Lab 9

Getting started with WLAN Access point & Station using CC3100SDK using CCS and SimplinkWiFi Library.

Lab 10

Import and execute Email Send Application using CC3100 SDK in CCS and understand Simplink API usage.

Note: Use either MSP430, Arduino or Raspberry pi Launch pad to perform the above experiments.

ADDITIONAL EXPERIMENTS

- Traffic light control interfacing
- Stepper motor control interfacing

Note: Use either MSP430, Arduino or Raspberry pi Launch pad to perform the above experiments.

<table>
<tr><td>Course Title</td><td colspan="4">Introduction to Machine Learning using Python</td><td colspan="4">B. Tech ECE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20SC508</td><td rowspan="2">SC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>1</td><td>-</td><td>2</td><td>2</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To create awareness on machine learning
- To know step by step procedure to run ML model
- To differentiate the supervised and unsupervised algorithms
- To know the architecture of ANN and CNN.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand fundamentals of Machine Learning
CO 2	Analyze flow chart to build a Machine Learning model
CO 3	Apply concepts of Machine learning in real time
CO 4	Develop ANN and CNN models for real time applications

UNIT-I

The Fundamentals of Machine Learning: Introduction, Types of Machine Learning Systems-Supervised/Unsupervised Learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning; Main Challenges of Machine Learning-Insufficient Quantity of Training Data, Non representative Training Data, Poor-Quality Data, Irrelevant Features, Over fitting the Training Data, Under-fitting the Training Data, Stepping Back, Testing and Validating.

UNIT-II

End-to-End Machine Learning Project: Working with Real Data, Look at the Big Picture- Frame the Problem, Select a Performance Measure, Check the Assumptions, Get the Data-Create the Workspace, Download the Data, Take a Quick Look at the Data Structure, Create a Test Set, Discover and Visualize the Data to Gain Insights-Visualizing Geographical Data, Looking for Correlations, Experimenting with Attribute Combinations, Prepare the Data for Machine Learning Algorithms-Data Cleaning, Handling Text and Categorical Attributes, Custom Transformers, Feature Scaling, Transformation Pipelines, Select and Train a Model.

UNIT-III

Classification : Training a Binary Classifier, Performance Measures-Measuring

Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall, Precision/Recall Tradeoff, The ROC Curve; Multiclass Classification, Error Analysis, Multi label Classification, Multi output Classification.

Training Models: Linear Regression, The Normal Equation, Computational Complexity, Gradient Descent-Batch Gradient Descent, Stochastic Gradient Descent, Mini-batch Gradient Descent; Polynomial Regression, Learning Curves, Regularized Linear Models, Ridge Regression, Lasso Regression, Elastic Net ,Early Stopping; Logistic Regression-Estimating Probabilities, Training and Cost Function, Decision Boundaries, Softmax Regression.

UNIT-IV

Support Vector Machines: Linear SVM Classification-Soft Margin Classification, Nonlinear SVM Classification-Polynomial Kernel, Adding Similarity Features, Gaussian RBF Kernel, and Computational Complexity

Dimensionality Reduction : The Curse of Dimensionality, Main Approaches for Dimensionality Reduction-Projection, Manifold Learning; PCA- Preserving the Variance, Principal Components, Projecting Down to d Dimensions, Using Scikit-Learn, Explained Variance Ratio, Choosing the Right Number of Dimensions, PCA for Compression, Incremental PCA, Randomized PCA, Kernel PCA.

UNIT-V

Introduction to Artificial Neural Networks: From Biological to Artificial Neurons,-Biological Neurons, Logical Computations with Neurons, The Perceptron, Multi-Layer Perceptron and Back propagation ;Training an MLP with Tensor Flow's High-Level API , Training a DNN Using Plain Tensor Flow -Construction Phase , Execution Phase Using the Neural Network, Fine-Tuning Neural Network Hyper parameters,-Number of Hidden Layers, Number of Neurons per Hidden Layer , Activation Functions

Convolutional Neural Networks : The Architecture of the Visual Cortex, Convolutional Layer
Filters, Stacking Multiple Feature Maps, Tensor Flow Implementation, Memory Requirements
Pooling Layer, CNN Architectures, LeNet-5, Alex Net, GoogLe Net and Res Net.

Text Books:

1. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems”, O’reilly publishers, 2017
2. Chris albon, “Machine Learning with Python cookbook”, O’reilly publishers, 2018

Reference Books:

1. Oliver Theobald, “Machine Learning For Absolute Beginners”, A Plain English Introduction (2nd Edition)
2. John Paul Mueller and Luca Massaron, “Machine Learning (in Python and R) For Dummies” (1st Edition)

<table>
<tr><td>Course Title</td><td colspan="5">Management & Organizational Behavior</td><td colspan="3">B. Tech ECE V Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20MC509</td><td rowspan="2">MC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>-</td><td>40</td><td>-</td><td>40</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: -</td></tr>
</table>

Course Objectives: The main objective of the course is to learn

- To aid students in understanding human behavior in organizations,
- To provide students with a comprehensive exposure to organizational behavior theories, research and workplace issues.
- The course also provides an overview of the theories and practices of management in organizational contexts.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Explain the Importance & Role of Management in the Organizations.
CO 2	Evaluate the different aspects related to Decision Making and Controlling Process
CO 3	Describe the different theories related to Individual behavior in the Organization
CO 4	Analyze Group Behavioral influence in the Organization.
CO 5	Evaluate the process and climate effects in Organization Behavior.

UNIT-I

Role of Management:

Concept – Significance – Functions – Principles of Management - Patterns of Management: Scientific – Behavioural – Systems – Contingency.

UNIT-II

Decision Making & Controlling – Process – Techniques. Planning – Process – Problems — Making It Effective. Controlling - System of Controlling – Controlling Techniques – Making Controlling Effective

UNIT-III

Individual Behaviour& Motivation – Understanding Individual Behaviour – Perception – Learning – Personality Types – Johari window- Transactional Analysis- Motivation – Concept of Motivation - Motivational Theories of Maslow, Herzberg, David McClelland, and Porter and Lawler

UNIT-IV

Group Behavior & Leadership: Benefits of Groups – Types of Groups – Group Formation and Development. Leadership and Organizational Culture and Climate:

Leadership – Traits Theory – Managerial Grid – Transactional Vs Transformational Leadership – Qualities of good leader- Women Leadership in India.

UNIT-V

OrganisationalBehaviour: Organizing Process – Departmentation Types – Making Organizing Effective – Organisational culture- Types of culture – Organisational Culture VsOrganisational climate - Conflict management - Change Management

Text Books:

1. Organisational Behaviour, Stephen P. Robbins, Pearson Education
2. Management and Organisational Behaviour, Subbarao P, Himalaya Publishing House
3. Principles of Management, Koonz,Weihrich and Aryasri, Tata McGraw Hill.

Reference Books:

1. Organisational Behaviour ,S.S.Khanka, S.Chand
2. Organisational Behaviour , Mishra .M.N ,Vikas
3. Management and Organisationalbehaviour, Pierce Gordner, Cengage.
4. Behaviour in Organizations, Hiriyappa .B.New Age Publications
5. Organisational Behaviour, Sarma, Jaico Publications.
6. Principles of Management ,Murugesan ,Laxmi Publications

B.Tech VI SEM ECE (R20)

Course Title	Digital Signal Processing					B. Tech ECE VI Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004601	PCC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	--	--	3	40	60	100
Mid Exam Duration: 90Min					End Exam Duration: 3Hrs			

Course Objectives:

- To become familiar with Discrete Fourier Transform and its efficient computation.
- To understand various IIR and FIR realization techniques.
- To know the design of IIR and FIR filters.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Apply FFT to compute DFT and IDFT, Various transformation techniques and Windows in designing digital filters, Decimation and Interpolation in the development of Multirate systems.
CO 2	Realize Various Digital Filters.
CO 3	Solve problems related to IIR and FIR filters, sampling rate conversion.
CO 4	Design IIR filters, FIR filters, Decimator and Interpolator.

UNIT-I

Discrete Fourier series: DFS representation of periodic sequences, Properties of discrete Fourier series, Discrete Fourier Transform (DFT), properties of DFT, linear convolution of sequences using DFT.

Fast Fourier Transforms: Efficient computation of the DFT, Decimation in time and decimation in frequency FFT algorithms, FFT algorithms for composite N.

UNIT-II

Realization of Digital Filters: Block diagram representation of linear constant-coefficient difference equations, basic structures of IIR filters- direct form I, direct form II, transposed form, cascade form, parallel forms, basic structures of FIR filters-Direct form, Cascade form, Linear phase structure, Lattice structures.

UNIT-III

IIR Digital Filters: General considerations-Causality and its implications, Characteristics of Practical Frequency-selective filters, Design of analog filters-Butterworth and chebyshev approximations, IIR filter design by backward difference, Impulse Invariance, Bilinear transformation, design examples: frequency transformations, Illustrative Problems.

UNIT -IV

FIR Digital Filters: Symmetric and Anti-symmetric FIR filters, Design of Linear Phase FIR digital filters using windows, Frequency sampling technique, comparison of IIR and FIR filters, Illustrative Problems, applications of DSP (Dual Tone Multifrequency signal detection, Spectral analysis of sinusoidal and non-stationary signals).

UNIT- V

Multirate Signal Processing: Review of sampling, Introduction to Multirate sampling, Decimation, and interpolation, Sampling rate conversion by a rational factor, Multistage implementation of sampling rate conversion, Applications of multi rate signal processing.

Text Books:

1. A.V. Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd ed., Pearson Education, 2012.

2. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and Aapplications", Pearson Education/PHI, 4th Edition, 2007.

3. Sanjit K Mitra, "Digital signal processing", A computer base approach- Tata McGraw-Hill, 3rd Edition, 2009.

Reference Books:

1. Andreas Antoniou, Digital signal processing: Tata McGraw-Hill, 2006.
2. Digital signal processing: M H Hayes, Schaum's Outlines, Tata McGraw-Hill, 2007.
3. A. Anand Kumar, "Digital Signal Processing," PHI Learning, 2011.

<table>
<tr><td>Course Title</td><td colspan="4">Microwave Engineering</td><td colspan="3">B. Tech ECE VI Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004602</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To get familiarized with microwave frequency bands, their applications and to understand the limitations and losses of conventional tubes at these frequencies.
- To impart Knowledge about various microwave components, microwave junctions, microwave tubes and microwave signal characteristic measurements.
- To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S Matrix for various types of microwave junctions.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	List applications of microwaves and state principles of various microwave devices (L1)
CO 2	Explain principle and working of microwave tubes and semiconductor devices (L2)
CO 3	Describe fabrication of Microstrip lines; Microwave bench setup for various microwave measurements (L2)
CO 4	Determine S – parameters of various microwave devices (L3)
CO 5	Compute microwave signal parameters, power output and efficiency of microwave active devices (L4)

UNIT-I

Microwave Transmission Lines: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM modes, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations, Impossibility of TEM mode. Related Problems.

Microstrip Lines: Introduction, Characteristic Impedance of Microstrip lines, Zo Relations, Effective Dielectric Constant, Losses.

UNIT-II

Microwave Tubes: Limitations and Losses of conventional tubes at microwave frequencies, Re-entrant Cavities, Microwave tubes – O type and M type classifications, Otype tubes :2 Cavity Klystrons – Structure, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory –, Applications, Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Electronic Admittance; Oscillating Modes and output Characteristics, Electronic and

Mechanical Tuning, Applications,

UNIT-III

Helix TWTs: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Suppression of Oscillations.

M-type Tubes: Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron – Hull Cut-off Condition, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics.

UNIT-IV

Waveguide Components and Applications: Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types, Scattering Matrix– Significance, Formulation and Properties, S-Matrix Calculations for – 2 port Junction, E-plane and H-plane Tees, Magic Tee, Hybrid Ring; Directional Couplers – 2Hole, Bethe Hole types, Ferrite Components– Faraday Rotation, Gyrator, Isolator, Circulator and case studies.

UNIT-V

Microwave Solid State Devices: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diode – Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes, IMPATT Diode, Varactor Diode, case studies.

Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method. Measurement of Attenuation, Frequency, Q- factor, Phase shift, VSWR, Impedance Measurement.

Text Books:

1. Samuel Y. Liao, ‘Microwave Devices and Circuits,’ PHI, 3rd Edition, 2003.

2. Annapurna Das and Sisir K.Das, ‘Microwave Engineering,’ McGraw Hill Education, 3rd Edition, 2017.

Reference Books:

1. R.E. Collin, ‘Foundations for Microwave Engineering,’ John Wiley, 2nd Edition, 2007.

2. M.Kulkarni , ‘Microwave and Radar Engineering,’Umesh Publications, 4th Edition, 2012.

3. George Kennedy, ‘Electronic Communication System,’McGrawHill, 6th Ed., 2017.

4. David M. Pozar, ‘Microwave Engineering, An Indian Adaptation: Theory and Techniques,’ Wiley, 2020.

<table>
<tr><th>Course Title</th><th colspan="5">Control Systems</th><th colspan="3">B. Tech ECE VI Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">2004603</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90mins</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To learn Merits and demerits of open loop and closed loop systems; the effect of feedback
• The use of block diagram algebra and Mason’s gain formula to find the overall transfer function
• To learn Transient and steady state response, time domain specifications and the concept of Root loci.
• To learn Frequency domain specifications, Bode diagrams and Nyquist plots
• To learn State space modeling of Control system</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the concepts of control systems classification, feedback effect, mathematical modeling, time response and frequency response characteristics, state space analysis</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze time response analysis, error constants, and stability characteristics of a given mathematical model using different methods</td></tr>
<tr><td>CO 3</td><td colspan="8">Apply various criteria to test the stability of a given system.</td></tr>
<tr><td>CO 4</td><td colspan="8">Design and develop different compensators, controllers and their performance evaluation for various conditions. Implement them in solving various engineering applications</td></tr>
</table>

UNIT-I

Control System Concepts: Open loop and closed loop control systems and their differences- Examples of control systems-classification, transfer function, effect of feedback, mathematical modeling of physical systems, block diagram, reduction techniques, signal flow graphs and mason’s gain formula.

UNIT-II

Time Domain Analysis: Standard test signals, time response of first and second order systems- time response specifications, steady state error and error constants, response of P, PI, and PID controllers.

UNIT-III

Concept of Stability and Root Locus: The concept of stability, necessary conditions for stability – routh Hurwitz’s criterion – limitations of routh’s stability – root locus concept – construction of root loci, effect of poles & zeros on stability, case studies.

UNIT-IV

Frequency Domain Analysis: Introduction, correlation between time and frequency response, frequency domain specifications, bode plots, Nyquist stability criterion - gain and phase margin.

UNIT-V

Compensation Techniques: System design and compensation-realization of basic lead, lag and lead-lag cascade compensation in frequency domain.

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and its Properties.

Text Books:

1. Katsuhiko Ogata, “Modern Control Engineering”, 5^{th}edition, Prentice Hall of India Pvt. Ltd., 2010.
2. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, 5^{th}edition, New Age International (P) Limited Publishers, 2007.
3. “Control Systems” by A. Anand Kumar, Prentice Hall of India Pvt. Ltd.
4. Control System Engineering byA. NagoorKani,RBA PUB

Reference Books:

1. M.Gopal, “Control Systems Principles & Design”, 4 th Edition, Mc Graw Hill Education, 2012.
2. B. C. Kuo and Farid Golnaraghi, “Automatic Control Systems”, 8 th edition, John wiley and sons, 2003.
3. Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, “Feedback and Control Systems”, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, “Control System Design” Pearson, 2000.

Course Title	CMOS VLSI Design					B. Tech ECE VI Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004604	PEC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	--	3	40	60	100
Mid Exam Duration: 90Min					End Exam Duration: 3Hrs			

Course Objectives:

The main objectives of this course are:

- Basic characteristics of MOS transistor and examines various possibilities for Configuring inverter circuits and aspects of latch-up are considered.
- Design processes are aided by simple concepts such as stick and symbolic diagrams but the key element is a set of design rules, which are explained clearly.
- Circuit parameters which greatly ease the design process. Understand the concepts of scaling MOS circuits.
- Understand FPGA design, synthesis and different case studies.
- Need for Design of Low-Power VLSI Circuits.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the properties, Layout, Stick Diagrams, parameters of MOS devices and Sources of Power Dissipation.
CO 2	Analyze the inverters, Stick Diagrams, propagation delay, FPGA design flow, Logic synthesis and Power Dissipation.
CO 3	Apply Design Rules and Layout diagrams, CMOS logic.
CO 4	Design inverters, layouts, CMOS Logic Structures
CO 5	Synthesize RTL, logic and high level models.

UNIT-I

Introduction and Basic Electrical Properties of MOS Circuits: VLSI Design Flow, Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, body bias effect, Latch-up in CMOS circuits, Bi-CMOS Inverter, Comparison between CMOS and Bi-CMOS technology.

UNIT-II

MOS and Bi-CMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout, Generalobservations on the Design rules, 2µ m Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2µ m

Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams- Translation to Mask Form.

UNIT-III

Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, some area Capacitance Calculations, The Delay Unit, Inverter Delays, driving large capacitive loads, Propagation Delays.

Scaling Of MOS Circuits: Scaling models and scaling factors, scaling factors for device parameters, Limitations of scaling.

CMOS Logic Structures: Static CMOS Design (CMOS logic, Pseudo-nMOS logic, Transmission gate logic, Pass transistor logic), Dynamic CMOS Design (Dynamic CMOS logic, Domino CMOS logic, Clocked CMOS Logic, Cascade Voltage Switch Logic)

UNIT-IV

FPGA Design: FPGA design flow, Basic FPGA architecture, FPGA Technologies, Introduction to FPGA Families, Xilinx XC4000 series FPGA, Xilinx Spartan II FPGAs, and Xilinx Vertex FPGA, case studies.

Introduction to synthesis: Logic synthesis, RTL synthesis, High level Synthesis.

UNIT-V

Sources of Power Dissipation: Introduction, Short-Circuit Power Dissipation, Dynamic Power Dissipation, Leakage Power Dissipation, Total power dissipation, Voltage Scaling, Reduction of Switched Capacitance, Reduction of Switching Activity, Need for low-power VLSI Design.

Text Books:

1. Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, “Essentials of VLSI Circuits and Systems”, Prentice-Hall of India Private Limited, 2005 Edition.

2. Sung-Mo Kang, YusufLeblebici, “CMOS Digital Integrated Circuits Analysis and Design”, Tata McGraw- Hill Education, 2003 Edition.

Reference Books:

1. Michael D.Ciletti, “Advanced Digital Design with the Verilog HDL”, Xilinx DesignSeries, Pearson Education.

2. A. Bellamour, M. I. Elamasri, “Low Power CMOS VLSI Circuit Design”,Kluwer Academic Press, 1995.

Course Title	**Information Theory and Coding**					**B. Tech ECE VI Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004605	**PEC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**-**	**--**	**3**	**40**	**60**	**100**
Mid Exam Duration: 90Min						**End Exam Duration: 3Hrs**		

Course Objectives:

- To know various information measures.
- To understand various information channels.
- To explain different source code algorithms.
- To familiarize quantization and transform coding.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand concepts of Dependent &Independent Source, Measure of information, Entropy, Rate of information
CO 2	Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms.
CO 3	Model the continuous and discrete communication channels using input, output and joint probabilities.
CO 4	Analyze quantization and transform coding.

UNIT-I

Information Theory: Introduction to Information Theory and Coding, Definition of Information Measure and Entropy, Extension of An Information Source and Markov Source, Adjoint of An Information Source, Joint and Conditional Information Measure, Properties of Joint and Conditional Information Measures and A Morkov Source Properties of Joint and Conditional Information measures and a Markov source.

UNIT-II

Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property, Encoding of the Source Output, Shannon’s Encoding Algorithm, Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding.

UNIT-III

Information Channels I: Introduction to Information Channels, Equivocation and Mutual Information, Properties of Different Information Channels, Reduction of Information Channels, Properties of Mutual

Information and Introduction to Channel Capacity, Calculation of Channel Capacity for Different Information Channels, Shannon's Second Theorem.

UNIT-IV

Information Channels II: Error Free Communication Over Noisy Channel, Error Free Communication Over A Binary Symmetric Channel and Introduction to Continuous Sources and Channels, Differential Entropy and Evaluation of Mutual Information for Continuous Sources and Channels, Channel Capacity of A Band Limited Continuous Channel.

UNIT-V

Quantization: Introduction to Quantization, Lloyd-Max Quantizer, Companded Quantization, Variable Length Coding and Problem Solving in Quantizer Design, Vector Quantization, Transform Coding-Idea of Transform Coding, Choosing the weights of basis vector, forward transform, Energy preserving, Optimal bit allocation .

Text Books:

1. T. M. Cover, J. A, Thomas, "Elements of information theory," Wiely Interscience, 2 nd Edition, 2013
2. R. W. Hamming, "Coding and information theory," Prentice Hall Inc., 1986.

Reference Books:

1. Bose, "Information Theory, Coding and Cryptography", McGraw hill Education, 2017.
2. S. Gravano, "Introduction to Error Control Codes", Oxford, 2007.
3. Robert B. Ash, "Information Theory", Dover Publications, 2003.
4. Todd k Moon, "Error Correction Coding: Mathematical Methods and Algorithms", Wiley, 2021.

<table>
<tr><td>Course Title</td><td colspan="5">Sensors And Actuators</td><td colspan="3">B. Tech ECE VI Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004606</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To know the importance of Sensors and Actuators.
• To understand working of magnetic sensors
• To understand actuators and solenoids
• To explain principles of operation and working of rotary actuators.
• To familiarize controls in NC machine fluidic system</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the principle of various sensors and actuators.</td></tr>
<tr><td>CO 2</td><td colspan="8">Compare various sensors and actuators and apply in real time scenario</td></tr>
<tr><td>CO 3</td><td colspan="8">Model linear actuators and differentiate various solenoids</td></tr>
<tr><td>CO 4</td><td colspan="8">Analyze the noise in various sensors and actuators, controls in NC machine and fluidic system.</td></tr>
</table>

UNIT-I

Introduction- Classification of Sensors and Actuators - Magnetic Sensors - Linear and Latching Solenoid Actuators - Stepper Motors - Special Magnetic Devices - Rotary and Linear Actuators - Magnetic Materials and Technology - Soft Magnetic Materials - Hard Magnetic Materials - Coating Technologies - Magnetic Materials Market and Applications.

UNIT-II

Magnetic Sensors - Theory of Magnetic Sensors - Magnetic Sensor Analysis - VR Sensors - Solid-State Sensors - Magnetic Sensor Applications - Magnetic Speed Sensor Requirements - Magnetic Speed Sensor Applications - Magnetic Position Sensor Applications - VR Sensor Noise.

UNIT-III

Gas sensors- Optical gas sensor- Metal oxide semiconductor gas sensor- Field effect transistor gas sensor- Piezoelectric gas sensor- Polymer gas sensor- Nano-structured based gas sensors.

UNIT-IV

Rotary Actuators - Disk Rotary Actuators - Disk Rotary Actuator Analysis - Disk Rotary Actuator Design - Disk Rotary Actuator Excitation Electromagnetic Circuit - Disk Rotary Actuator Toothed Magnetic Part - Disk Rotary Actuator PM - Claw Pole Rotary Actuators - Claw Pole Rotary Actuator Analysis - Claw Pole Rotary Actuator Design -Claw Pole Rotary Actuator Excitation Electromagnetic Circuit - Claw Pole Actuator Toothed Magnetic Part - Claw Pole Actuator PM - Cylindrical Rotary Actuators - Cylindrical Rotary Actuator PM - Cylindrical Rotary Actuator Excitation Electromagnetic Circuit - Cylindrical Rotary Actuator Toothed Magnetic Structure - Rotary Actuator Applications - Disk Rotary Actuator Application - Claw Pole Rotary Actuator Application - Cylindrical Rotary Actuator Application.

UNIT-V

Controls in NC Machines and fluidic control- stepping motors- feedback devices- encoders - resolvers - inductosync –Tachogenerators - principles of fluid logic control -Coanda effect - basic fluidic devices - fluidic logic gates – bistable flipflop - OR and NOR gates - exclusive OR gates - fluidic sensors - backpressure sensor - cone jet proximity sensor - interruptible jet sensor.

Text Books:

1. Andrzej M. Pawlak , “Sensors and Actuators in Mechatronics, Design and Applications” , Taylor & Francis Group, 2006

2. Andrew Parr, “Hydraulics and Pneumatics“, Jaico Publishing House, Mumbai.

Reference Books:

1. YoramKoren, ‘Computer control of Manufacturing Systems’, Tata McGraw Hill Publishers, New Delhi

2. Robert H. Bishop, “Mechatronic systems, Sensors and Actuators Fundamentals and Modelling, Taylor & Francis Group, 2007

3. Adams, Thomas M., Layton, Richard A., “Introductory MEMS- Fabrication and Applications” -, Spinger, 2010.

4. Tai-Ran Hsu , MEMS and Microsystems: Design and manufacture, ,McGraw-Hill, 2002

Course Title	**Human Resource Development**					**B. Tech ECE VI Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2006601	**HSC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Mid Exam Duration: 2Hrs						**External Exam Duration: 3Hrs**		

Course Objectives: The main objective of the course is to learn

- To develop capability of all individuals working in an organization in relation to their present role.
- To develop team spirit.
- To develop co-ordination among different units of an organization.
- To develop organization health by continuous reveal of individual capability keeping peace with the technological changes.
- To develop better interpersonal & employer-employee relationships in an organization.

Course Outcomes: On success Completion This course, the students will be able to

CO1	To understand key functions in management as applied in practice.
CO2	To understand in more specific management related areas from planning till controlling.
CO3	To understand about the authority and responsibility, and different organizational structure.
CO4	To understand about the role of leadership, motivation and communication in an organization.
CO5	To understand the importance of globalization and diversity in modern organizations.

UNIT-I

Introduction to Human Resource Development: Meaning, significance and objectives of Human Resource Development, Human Resource Management and Human Resource development functions, Human Resource Development challenges.

UNIT-II

HRD Need Assessment & Designing of HRD programs: Strategic/ Organizational Analysis- Task Analysis- Person Analysis- prioritizing HRD needs, defining the objectives of HRD Intervention - Selecting the trainer - Selecting the Training methods - Preparing training material Scheduling an HRD program.

UNIT-III

Implementation &Evaluation of HRD programs: Training methods - Classroom training Approaches - Computer based Training, Purpose of HRD Evaluation- Kirkpatrick's evaluation frame work - Data collection for HRD Evaluation - Assessing the impact of HRD programs in Monetary Terms.

UNIT-IV

Career Management and Development: Introduction to Career management, meaning - Stages of life and Career Development - process of career Development - Issues in career development.

UNIT-V

HRD & Diversity: Introduction – Organizational culture – Labor Market changes and discrimination adapting to demographic changes

Text books:

1. Jon M Werner,Randy L DeSimone: Human Resource development (Thomson/Cengage)
2. Raymond A Noe: Employee Trainee Development (Tata McGraw Hill)
3. Dr. D.K Bhattacharya, Himalaya Publishing House

Reference Books:

1. John P. Wilson Human Resource Development (Kogan Page Business Books)
2. Tripathi P.C : Human Resource Development (Sultan Chand & Sons)
3. Uday Kumar Haldar : Human Resource Development (Oxford)

<table>
<tr><td>Course Title</td><td colspan="5">Digital Marketing</td><td colspan="3">B. Tech ECE VI Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2006602</td><td rowspan="2">HSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 2Hrs</td><td colspan="3">External Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The main objective of the course is to learn
• To provide foundation in the key concepts on digital marketing.
• Understand how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy.
• Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan.
• Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media
• Learn how to measure digital marketing efforts and calculate ROI</td></tr>
<tr><td colspan="9">Course Outcomes: On success Completion This course, the students will be able to</td></tr>
<tr><td>CO1</td><td colspan="8">Analyze the confluence of marketing, operations, and human resources in real-time delivery.</td></tr>
<tr><td>CO2</td><td colspan="8">Demonstrate cognitive knowledge of the skills required in conducting online research and research on online markets, as well as in identifying, assessing and selecting digital market opportunities.</td></tr>
<tr><td>CO3</td><td colspan="8">Explain emerging trends in digital marketing and critically assess the use of digital marketing tools by applying relevant marketing theories and frameworks.</td></tr>
<tr><td>CO4</td><td colspan="8">Investigate and evaluate issues in adapting to globalized markets that are constantly changing and increasingly networked.</td></tr>
<tr><td>CO5</td><td colspan="8">Interpret the traditional marketing mix within the context of a changing and extended range of digital strategies and tactics.</td></tr>
</table>

UNIT-I

Understanding Digital Marketing: Concept, Components of Digital Marketing, Need and Scope of Digital Marketing, Benefits of Digital Marketing, Digital Marketing Platforms and Strategies, Comparison of Marketing and Digital Marketing, Digital Marketing Trends.

UNIT-II

Channels of Digital Marketing: Digital Marketing, Website Marketing, Search Engine Marketing, Online Advertising, Email Marketing, Blog Marketing, Social Media Marketing, Mobile Marketing, Migrating from Traditional Channels to Digital Channels. Marketing in the Digital Era Segmentation – Importance of Audience Segmentation, How Different Segments use Digital Media - Digital Media for Customer Loyalty.

UNIT-III

Digital Marketing Plan: Need of a Digital Marketing Plan, Elements of a Digital Marketing Plan – Marketing Plan, Executive Summary, Mission, Situational Analysis, Opportunities and Issues, Goals and Objectives, Marketing Strategy, Action Plan, Budget, Writing the Marketing Plan and Implementing the Plan.

UNIT-IV

Search Engine Marketing and Online Advertising: Importance of SEM, Understanding Web Search – Keywords, HTML Tags, Inbound Links, Online Advertising vs. Traditional Advertising, Payment Methods of Online Advertising – CPM (Cost-per-Thousand) and CPC (Cost-per-Click), Display Ads - Choosing a Display Ad Format, Landing Page and its Importance.

UNIT-V

Social Media Marketing: Understanding Social Media, Social Networking with Face book, LinkedIn, Blogging as a Social Medium, Social Sharing with YouTube. Measurement of Digital Media: Analyzing Digital Media Performance, Analyzing Website Performance, Analyzing Advertising Performance.

Text Books:

1. Seema Gupta, Tata McGraw Hill.
2. Dave Chaffey, Pearson Education
3. Dr AntornyPuthussery

Reference Books:

1. Kevin Hartman, Digital Marketing Analytics,

2. Digital Marketing – Self learning management series, Vibrant Publishers
3. Digital Marketing, Vandana Ahuja, Oxford publishing house
4. Fundamentals of Digital Marketing, Puneet Singh Batia – Pearson Education
5. Digital Marketing by Seema Gupta (IIM-B)
6. Digital Marketing: Strategy, Implementation¬& Practice by Dave Chaffey & Fiona Ellis Chad wick
7. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation - Damian Ryan and Calvin Jones.

Course Title	**Project Management**					**B. Tech ECE VI Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2006603	**HSC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Mid Exam Duration: 2Hrs						**External Exam Duration: 3Hrs**		

Course Objectives: The main objective of the course to learn

- To impart the basic concepts of Project selection.
- To develop an understanding of Project Planning and design, construction and execution, monitoring and control, completion.
- To achieve the Project's main goal within the constraints.
- To optimize the allocated necessary inputs.
- To shape and reform the client's vision or tone got late with the masregards the project's objectives.

Course Outcomes: On success Completion This course, the students will be able to

CO1	Remembering and recalling the principles of project management and methods involved in the process of project management.
CO2	Understanding of Project Planning, design, construction, execution, maintaining and controlling.
CO3	Applying techniques in Project Evaluation, Scheduling and Controlling.
CO4	Classifying and analysis risks in Project management and project scheduling.

UNIT-I

Introduction to Project Management: Need for Project management, Taxonomy of project, Project life cycle, Project management Process, Principles of Project Management. Project Identification and Selection, Pre – feasibility study, Project Planning Process, Resources allocation, Project Break-even Point.

UNIT-II

Financial Evaluation of Projects: Cost of the Project, Means of finance, Financial Evaluation of projects – Payback period method, Accounting Rate of Return method, Net Present Value method, Internal Rate of Return method, Benefit Cost Ratio method (Profitability Index), (simple Problems).

UNIT-III

Project Risk & Quality Management: Introduction, Role of Risk management, Risk Identification – Steps in risk management –, Risk analysis (Sensitivity Analysis, Probability Analysis, Mean – Variance Analysis Decision trees, Simulation), Techniques for managing risk. Project Quality Management and ValueEngineering:Quality,Quality Concepts and Value Engineering.

UNIT-IV

Project Scheduling (Network Analysis): Development of Project network, Time estimation, Determination of the critical Path, PERT Model, Project Crashing.(Simple Problems)

UNIT-V

Project Execution & PMS: Process Of Project Execution and Control, Project Management Information System (PMIS), Project Performance Measurement and Evaluation (PPME).

Project Management Software: Essential Requirement of Project Management Software, Common Features available in most of the project management software.

Text Books:

1. Project management Best Practices: Achieving Global Excellence by Harold Kerzner; John Wiley & Sons; 3rd edition.
2. Project Management: Engineering, Technology and Implementation: united states Edition by Avraham Shtub and Jonathan F.Bard, Pearson; 1st edition.
3. The Essentials of Project Management by Dennis Lock; Routledge.
4. PrasannaChandra,Projects,TataMcGrawHill.
5. NagarajanK,ProjectManagement4th edition,NewAgeInternational(P)Ltd.

6. LSSrinath,PERT/CPM,AffiliatedEast-WestPress2005.

Reference Books:

1. Project management by Stephen Hartley; Routledge, 4th Edition.
2. Project management: a systems Approach to Planning, Scheduling, and controlling by Harold Kerzner; Wiley; 12th edition.
3. Project Management & Appraisal by SitangshuKhatua; published by Oxford University.
4. NicholasJ.M.&Steyn H, Project Management, Elsevier,Himalayapublications.
5. NarendraSingh,ProjectManagement and Control,HPH,2003.
6. Harvey Maylor, Project Management,PearsonEducation.
7. Panneerselvam Senthilkumar,ProjectManagement,PHI.

<table>
<tr><th>Course Title</th><th colspan="5">Digital Signal Processing Lab</th><th colspan="3">B. Tech ECE VI Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">2004607</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>-</td><td>--</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To become familiar with MATLAB fundamentals
- To write MATLAB programme for basic DSP operations
- To understand the uses of TMS320C6748 processors
- To write C language code for basic DSP operations and executed using TMS processors

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Analyze discrete/digital signals using mat lab and the basic operations of signal processing.
CO 2	Obtain the spectral parameters of windowing functions.
CO 3	Design FIR and IIR filters for desired specifications
CO 4	Design and implement DSP algorithms in software using a computer language such as C with TMS320C6748 floating point processor.

List of Experiments: (Minimum of 5 experiments are to be conducted from each part)

Software Experiments (PART – A)

1. Frequency response of a system described by a difference equation.
2. Generation of DTMF Signals.
3. To compute power density spectrum of a sequence.

4. Convolution of two discrete-time sequences with and without built in command.
5. Correlation between two discrete-time sequences with and without built in command.
6. DFT of a given signal with and without built in command.
7. Design of FIR filter using windowing technique.
8. Design of IIR filters using Impulse invariance or bilinear transformation.
9. Implementation of a Decimation Process.
10. Implementation of a Interpolation Process.

Using DSP Processor kits (Floating point) and Code Composure Studio (CCS) (PART – B)

1. Introduction to DSP Processors.
2. Generation of Sine wave & Square wave.
3. Finding Power and (or) Energy of a given signal.
4. Convolution of two discrete-time sequences.
5. Correlation between two discrete-time sequences.
6. DFT of a given signal
7. Design of FIR filter using windowing technique and verify the frequency response of the filter.

Course Title	**Microwave & Optical Communications Lab**					**B. Tech ECE VI Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004608	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		-	**-**	**3**	**1.5**	**40**	**60**	**100**
Mid Exam Duration: 90Min						**End Exam Duration: 3Hrs**		

Course Objectives:

- To provide knowledge on various types of microwave sources.
- To verify the S-matrix of different Junctions
- To study waveguide and attenuation characteristics.
- To study the characteristics of optical sources and measure optical fiber parameters.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Analyze the characteristics of different microwave sources.
CO 2	Measure the parameters of wave guide and microwave junctions.
CO 3	Examine the characteristics of optical fiber and sources.
CO 4	Analyze the microwave antenna performance

Part – A (Any 7 Experiments):

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.

3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. VSWR Measurement.
6. Impedance Measurement.
7. Waveguide parameters measurement.
8. Scattering parameters of Directional Coupler.
9. Scattering parameters of Magic Tee.
10. Characteristic of Three Port Circulator

Part – B (Any 5 Experiments):

1. Characterization of LED.
2. Characterization of Laser Diode.
3. Intensity modulation of Laser output through an optical fiber.
4. Measurement of Data rate for Digital Optical link.
5. Measurement of NA.
6. Measurement of losses for Analog Optical link.
7. Radiation Pattern Measurement of Horn Antenna.
8. Radiation pattern of Microstrip Patch antennas.

<table>
<tr><td>Course Title</td><td colspan="5">VLSI Design Laboratory</td><td colspan="3">B. Tech ECE VI Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004609</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>--</td><td>-</td><td>3</td><td>1.5</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6"></td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
The main objectives of this course are:
• Understanding basic laws and rules of designing the digital circuits.
• Analyzing the Concepts of Simulation Results, RTL Schematic</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Design and simulate basic CMOS circuits like inverter and basic logic gates.</td></tr>
<tr><td>CO 2</td><td colspan="8">Design and simulate adders and subtractors.</td></tr>
<tr><td>CO 3</td><td colspan="8">Realize various flip-flops and encoder & decoder.</td></tr>
<tr><td>CO 4</td><td colspan="8">Generate RTL schematic for the combinational & sequential Circuits.</td></tr>
<tr><td>CO 5</td><td colspan="8">Verify the logic using FPGA.</td></tr>
</table>

NOTE:

- The students are required to design and implement **any 12 Experiments** using Xylinx Vivado tool/Industry Equivalent Standard Software.
- The students are required to implement and verify its synthesis **of any FOUR Experiments using FPGA.**

List of Experiments:

1. Design and Implementation of a CMOS Inverter.
2. Design and Implementation of an Universal Gates
3. Design and Implementation of an XOR and XNOR Gates.
4. Design and Implementation of a Boolean expression $Y = \overline{(AB + CD + E)}$
5. Design and Implementation of Half-adder and Half-subtractor.
6. Design and Implementation of 1-bit Full Adder.
7. Design and Implementation of 4-bit Ripple Carry Adder.
8. Design and Implementation of 2-bit Binary multiplier.
9. Design and Implementation of 2*1 MUX.
10. Design and Implementation of 2 to 4 Decoder
11. Design and Implementation of RS-Latch
12. Design and Implementation of D-Flip-flop
13. Design and Implementation asynchronous counter
14. Design and Implementation of static RAM cell
15. Design and Implementation of Differential Amplifier.

Lab Requirements:

1. **Software:** Xylinx Vivado tool/Industry Equivalent Standard Software.
2. **Hardware:** Personal Computer with necessary peripherals, configuration and operating System and FPGAs.

Course Title	Advanced English Communication Skills Lab				B. Tech ECE VI Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20SC610	**SC**	**L**	**T**	**P**	**C**	**Internal Assessment**	**External Exam**	**Total**
		1	**--**	**2**	**2**	**40**	**60**	**100**
					End Exam Duration: 3Hrs			

Course Objectives:

- To focus on improving the student's proficiency in English at all levels.
- To train students to use language effectively to participate in group discussions,
- To help them face interviews and sharpen public speaking skills
- To enhance the confidence of the student by exposing him/her to various situations and contexts which he/she would face in his/her career.
- To make students industry-ready.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe Speaking and listening skills
CO 2	Understand various kinds of reports and present them schematically

CO 3	Analyze Behavioural skills
CO 4	Illustrate various employability skills required for the employment
CO 5	Classify the verbal and non-verbal communication

1. Syllabus:

The following course content is prescribed for the Advanced English Communication Skills:

Functional English – Introduction -- Starting & Responding a Conversation-- Social Etiquette Conversation -- role play – Body language in conversation—departure phrases.

Technical Report Writing --- Types of formats and styles, subject matter, organization, clarity, coherence and style, data-collection, tools, analysis

Resume' Writing --- Structure, format and style, planning, defining the career, objective, projecting one's strengths, and skills, creative self-marketing, cover letter

Group Discussion--- Communicating views and opinions, discussing, intervening.Providing solutions on any given topic across a cross-section of individuals, (keeping an eye on modulation of voice, clarity, body language, relevance, fluency and coherence) in personal and professional lives.

Interview Skills --- Concept and process, pre-interview planning, mannerisms, body language, organizing, answering strategies, interview through tele and video-conferencing.

Technical Presentations (Oral) --- Collection of data, planning, preparation, type, style and format, use of props, attracting audience, voice modulation, clarity, body language, asking queries.

2. Minimum Requirements

The English Language Lab shall have two parts:

The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self-study by learners.

The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a TV, A digital stereo-audio and video system, Camcorder etc.

System Requirement (Hardware Component):

Computer network with LAN with a minimum of 60 multimedia systems with the following specifications:

P-IV Processor, Speed-2.8 GHz, RAM_512 MB minimum, Hard Disk-80 GB, Headphones

Prescribed Software: Walden and K-Van Solutions.

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. **Technical writing and professional communication, Huckin and Olsen** Tata McGraw-Hil 2009.

2. **Speaking about Science,** A Manual for Creating Clear Presentations **by Scott Morgan and Barrett Whitener, Cambridge University press, 2006**.

3. **Handbook for Technical Writing** by David AMcMurrey& Joanne Buckely CENGAGE Learomg 2008.

4. **Technical Communication** by Meenakshi Raman &Sangeeta Sharma, Oxford University Press 2009.

5. **The ACE of Soft Skills** by Gopal Ramesh and Mahadevan Ramesh, Pearson Education, 2010.

6. **Cambridge English for Job-Hunting** by ColmDownes, Cambridge Unicversity Press, 2008.

7. **Resume's and Interviews** by M. Ashraf Rizvi, Tata McGraw-Hill, 2008.

8. **From Campus to Corporate** by KK Ramachandran and KK Karthick, Macmillan Publishers India Ltd, 2010.

9. **English Language Communication: A Reader cum Lab Manual**DrA Ramakrishna Rao, Dr G Natanam& Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.

Course Title	**Constitution of India**					**B. Tech ECE VI Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20MC611	**MC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		2	**-**	**-**	**-**	**40**	**-**	**40**
					End Exam Duration: -			

Course Objectives: The main objective of the course to learn

- To realize the significance of the constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
- To identify the importance of fundamental rights as well as fundamental duties.
- To understand the functioning of Union, State and Local Governments in the Indian federal system.
- To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe the historical background of the constitution making and its importance for building a democratic India.
CO 2	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary.

CO 3	Explain the value of the fundamental rights and duties for becoming good citizen of India.
CO 4	Analyze the decentralization of power between central, state and local self government.
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

UNIT-I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution – Sources and constitutional history, Features – Citizenship, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Center- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Centr al Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions.

UNIT-III

State Government and its Administration Governor – Role and Position – CM and Council of ministers, State Secretariat: Organization, Structure and Functions.

UNIT-IV

Local Administration: District's Administration Head – Role and Importance, Municipalities – Mayor and role of Elected Representative – ZillaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy – (Different departments), Village level – Role of Elected and Appointed officials.

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissioner State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women.

Text Books:

1. M.V.Pylee, "Introduction to the Constitution of India",4th Edition, Vikas publication,2005.

2. Durga Das Basu(DD Basu) , "Introduction to the constitution of India",(Student Edition),19th edition,Prentice-Hall EEE, 2008.

Reference Books:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi

2. Subhash Kashyap, Indian Constitution, National Book Trust

3. J.A. Siwach, Dynamics of Indian Government & Politics

4. D.C. Gupta, Indian Government and Politics

5. H.M.Seervai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

6. J.C. Johari, Indian Government andPolitics Hans

7. J. Raj IndianGovernment and Politics

8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Righ t), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

E-Resources:

- nptel.ac.in/courses/109104074/8
- nptel.ac.in/courses/109104045/
- nptel.ac.in/courses/101104065/
- www.hss.iitb.ac.in/en/lecture-details
- www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution.

B.Tech VII SEM ECE (R20)

<table>
<tr><th>Course Title</th><th colspan="5">Nano Electronics</th><th colspan="3">B. Tech ECE VII Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">2004701</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To study the basics of nano-technology.
• To understand the structural models of nano devices.
• To understand the fabrication methods and nano sensors.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Apply electron theory, quantum of conductance in the field of Nano-electronics and nano sensors in the field of bio-sensing.</td></tr>
</table>

CO 3	Analyze the physical characteristics of nano structures, materials and Carbon nano tubes.
CO 4	Compare the performance of various fabrication techniques of nano scale devices

UNIT-I

Introduction: Classification of Nanostructures, Electronic properties of atoms and solids: Isolated atom, Bonding between atoms, Giant molecular solids, Free electron models and energy bands, crystalline solids, Periodicity of crystal lattices, Electronic conduction, effects of nanometer length scale, Fabrication methods: Top down processes, Bottom up processes methods for templating the growth of nanomaterials, ordering of nanosystems.

UNIT-II

Characterization: Classification, Microscopic techniques, Field ion microscopy, scanning probe techniques, diffraction techniques: bulk and surface diffraction techniques.

Inorganic semiconductor nanostructures: Overview of semiconductor physics. Quantum confinement in semiconductor nanostructures: quantum wells, quantum wires, quantum dots, super-lattices, band offsets, electronic density of states

UNIT-III

Fabrication techniques: Requirements of ideal semiconductor, epitaxial growth of quantum wells, lithography and etching, cleaved-edge over growth, growth of vicinal substrates, strain induced dots and wires, electrostatically induced dots and wires, Quantum well width fluctuations, thermally annealed quantum wells, semiconductor nanocrystals, collidal quantum dots, self-assembly techniques.

UNIT-IV

Carbon Nanostructures: Carbon molecules, Carbon Clusters, Carbon Nanotubes, application of Carbon Nanotubes.

UNIT-V

Nano sensors: Introduction, what is Sensor and Nano sensors? What makes them Possible? Order From Chaos, Characterization, Perception, Nano sensors Based on Quantum Size Effects, Electrochemical Sensors, Sensors Based On Physical Properties, Nano biosensors, Smart dust Sensor for the future.

Text Books:

1. Robert Kelsall, Ian Hamley and Mark Geoghegan, "Nanoscale Science and Technology", John Wiley, 2007.

2. Charles P Poole, Jr, Frank J Owens, "Introduction to Nanotechnology", John Wiley, Copyright 2006, Reprint 2011.

3. T Pradeep, "Nano: The essentials-Understanding Nanoscience and Nanotechnology", TMH.

Reference Books:

1. William A Goddard III, Donald W Brenner, Sergey E. Lyshevski and Gerald J Iafrate, "Hand Book of Nanoscience Engineering and Technology", CRC press, 2003.

<table>
<tr><th>Course Title</th><th colspan="4">Digital Image And Video Processing</th><th colspan="3">B. Tech ECE VII Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">2004702</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To study the image fundamentals and transforms necessary for image processing
- To learn the concepts of filtering in spatial and frequency domain
- To study different image compression techniques
- To understand image segmentation algorithms and Object recognition.

• To study video basics and motion estimation techniques	
Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Compute various image and video processing parameters
CO 2	Describe image filtering, segmentation and compression
CO 3	Compare different Color models, enhancement techniques, motion estimation techniques
CO 4	Apply the concepts of image and video processing techniques in various applications.
CO 5	Analyze coding and motion estimation methods in video processing.

UNIT-I

Introduction: Fundamentals of Image Processing: Digital image fundamentals, Applications of image processing, Image Sampling and Quantization, relationship between pixels. Relationship between pixels -neighbors of a pixel, Adjacency, Connectivity, Regions and boundaries, distance measures, Mathematical tools in digital image processing – Array versus matrix operations, Linear and Nonlinear Operations, Arithmetic operations, geometrical spatial transformations and image registration.

Color Images, Color models–RGB, CMYK, HSI;

UNIT-II

Image Enhancement: Spatial domain methods: Point processing, Histogram processing, Fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters.

Frequency domain methods: Basics of filtering in frequency domain, General approach for operating in the linear transform domain, 2-D DFT and Properties, image smoothing, image sharpening, Homomorphic filtering, LOG filters.

UNIT-III

Image Compression: Redundancies in images, Fidelity criteria, Image compression models, Error free compression – Variable length coding, Huffman coding, Arithmetic coding, LZW coding, Bit-plane coding, loss less and lossy predictive coding, Discrete cosine Transform, Transform coding, Image Compression standards.

Image Segmentation: Point, Line and Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation – Region growing, Region splitting and merging.

UNIT-IV

Introduction to Video processing : Definition of video signal, Analog and digital video, Spatial and temporal sampling, Video signal formats ,Video standards, Video coding basics, Need for video coding, Elements of a video coding system, Intraframe coding, Interframe coding, Three-Dimensional Coding, Interframe Predictive Coding, Frame differencing, Motion compensated prediction.

UNIT- V

Motion Estimation in Video Coding : Search Algorithms for Motion Estimation, Principle of Block Matching Algorithm, Full Search Algorithm, Fast Block Matching Algorithms- Two-Dimensional Logarithmic Search Algorithm, Three-Step Search Algorithm, Cross Search Algorithm, One-at-a-Time Search Algorithm, Proposed Modified Algorithms- New One-at-a-Time Algorithm, Modified Three-Step Search Algorithm.

Text Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008.
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004.
3. M. Tekalp , Digital Video Processing – Prentice Hall International
4. Shilpa Metkar and Sanjay Talbar "Motion Estimation Techniques for Digital Video Coding" Springer, 2013

Reference Books:

1. Scotte Umbaugh, Digital Image Processing and Analysis - Human and Computer Vision Application with CVIP Tools –2nd Ed, CRC Press, 2011.
2. Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing, Tata McGraw Hill Education, 2011.
3. Ed. Al Bovik ,"Handbook of Image and Video Processing", 2nd Edition, Academic Press, 2000.
4. Vipula Singh, Digital Image Processing with MATLAB and LabView, Elsevier.

Course Title	**Micro Electro-Mechanical Systems**					**B. Tech ECE VII Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004703	**PEC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**-**	**--**	**3**	**40**	**60**	**100**
Mid Exam Duration: 90Min						**End Exam Duration: 3Hrs**		

Course Objectives:

- Introduction to MEMS and micro fabrication
- To study the essential material properties

• To study various sensing and transduction technique • To know various fabrication and machining process of MEMS • To know about the polymer and optical MEMS	
Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Apply the sensors and polymers in MEMS for different applications.
CO 2	Compare Mechanical Properties of various Mems Materials
CO 3	Analyze various sensors and actuators, Bulk and Surface Micro-Machining.
CO 4	Design MEMS for various applications

UNIT- I

INTRODUCTION TO MEMS AND MICRO FABRICATION: History of MEMS Development, Characteristics of MEMS-miniaturization - Micro electronics integration - Mass fabrication with precision. Micro fabrication - Microelectronics fabrication process- Silicon based MEMS processes- new material and fabrication processing- points of consideration for processing.

UNIT-II

ELECTRICAL AND MECHANICAL PROPERTIES OF MEMS MATERIALS: Conductivity of semiconductors, crystal plane and orientation, stress and stain – definition – relationship between tensile stress and stain- mechanical properties of silicon and thin films, Flexural beam bending analysis under single loading condition- Types of beam- deflection of beam-longitudinal stain under pure bending- spring constant, torsional deflection, intrinsic stress, resonance and quality factor.

UNIT-III

SENSING AND ACTUATION: Electrostatic sensing and actuation-parallel plate capacitor – Application-Inertial, pressure and tactile sensor- parallel plate actuator- comb drive. Thermal sensing and Actuations-thermal sensors-Actuators- Applications- Inertial, Flow and Infrared sensors. Piezo resistive sensors- piezo resistive sensor material- stress in flexural cantilever and membrane- Application-Inertial, pressure, flow and tactile sensor.

PIEZOELECTRIC SENSING AND ACTUATION: piezoelectric material properties-quartz-PZT-PVDF – ZnO- Application-Inertial, Acoustic, tactile, flow-surface elastic waves. Magnetic actuation- Micro magnetic actuation principle- deposition of magnetic materials-Design and fabrication of magnetic coil.

UNIT-IV

BULK AND SURFACE MICRO-MACHINING: Anisotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), Isotropic wet etching, Basic surface micromachining process- structural and sacrificial material, stiction and antistiction methods, Foundry process.

UNIT-V

POLYMER AND OPTICAL MEMS: Polymers in MEMS- polymide-SU-8 liquid crystal polymer(LCP)-PDMS-PMMA-Parylene- Flurocorbon, Application-Acceleration, pressure, flow and tactile sensors. Optical MEMS-passive MEMS optical components-lenses-mirrors-Actuation for active optical MEMS.

Text Books:

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
2. Julian W.Gardner, Vijay K Varadhan, "Microsensors, MEMS and Smart devices", John Wiley & sons, 2001.

Reference Books:

1. Gaberiel M.Rebiz, "RF MEMS Theory,Design and Technology", John Wiley & Sons,2003.
2. Charles P.Poole, Frank J.Owens, "Introduction to nanotechnology" John Wiley & sons, 2003.

<table>
<tr><th>Course Title</th><th colspan="5">Wireless Communications</th><th colspan="3">B. Tech ECE VII Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">2004704</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration:90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To understand the design of a Wireless Communication system Concepts.
• To understand Broadband Wireless Channel Modeling, fundamentals of UWB.
• To study the various digital signaling techniques and Cellular mobile communication.</td></tr>
</table>

• To understand the concepts of OFDM and MIMO. • To understand the multiple Access techniques and architecture for different Wireless Systems.	
Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand 3G/4G Standards, Diversity, Cellular Communication. OFDM, MIMO OFDM.
CO 2	Apply basic principles to compute BER, Codes for CDMA and channel capacity.
CO 3	Analyze the characteristics of various Wireless Communication channels, Various channel models,
CO 4	Compare various channel characteristics, Multiple access schemes, various receivers and 3G/4G standards.
CO 5	Design Channel models, Receivers and MIMO Diversity

UNIT- I

Wireless Communications and Diversity: Introduction to 3G/4G Standards, Wireless Channel and Fading, Rayleigh Fading and BER of Wired Communication, BER for Wireless Communication, Introduction to Diversity, Multi-antenna Maximal Ratio Combiner, BER with Diversity, Spatial Diversity .

UNIT-II

Broadband Wireless Channel Modeling: Wireless Channel and Delay Spread, Coherence Bandwidth of the Wireless Channel, ISI and Doppler in Wireless Communications.

UWB (Ultra wide Band): UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit Error Rate Performance of UWB.

UNIT- III

Cellular Communication: Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes Call Setup, Handover etc., Telegraphic Theory.

CDMA: Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization.

UNIT-IV

OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues.

MIMO: Introduction to MIMO, MIMO Channel Capacity, SVD and Eigen modes of the, MIMO Channel , MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT, MIMO - OFDM.

UNIT-V

3G and 4G Wireless Standards- GSM, GPRS, WCDMA, LTE, WiMAX

Text Books:

1. Aditya K. Jagannatham, “Principles of Modern Wireless Communication Systems”, Publisher-McGraw Hill, 2017.

2. William C. Y. Lee, “Mobile Communications Engineering”, Mc Graw Hill Publications,1997.

Reference Books:

1. Theodore Rapp port, “ Wireless Communications: Principles and Practice”, Prentice Hall, 2010.

2. Ezio Biglieri, “MIMO Wireless Communications”, Cambridge University Press, 2009.

Course Title	DSP Processors and Architectures					B. Tech ECE VII Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004705	PEC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	-	3	40	60	100
Mid Exam Duration:90Min					End Exam Duration: 3Hrs			

Course Objectives: • To understand theory of different filters and algorithms • To understand theory of multirate DSP, solve numerical problems and write algorithms • To understand theory of prediction and solution of normal equations • To know applications of DSP at block level.	
Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand Aspects of architectures.
CO 2	Analyze Memory mapped accelerators
CO 3	Analyze DSP algorithms.
CO 4	Map the algorithms to architectures
CO 5	Design programmable systems

UNIT-I

DSP System Models: Introduction- Review of digital logic, Timing and Power in digital circuits, Quality metrics and bounds - Implementation Costs and Metrics, Architecture cost components, Examples of Architectures, Multi-objective Optimization.

Number representation- Scientific notation and Floating point

FIR and IIR Implementation: FIR filter, Serial FIR filter architectures, Simple programmable architecture, Block diagrams and SFGs, Dataflow Graphs, Iteration period, FIR filter iteration period, IIR filter iteration period, Computation Model.

UNIT-II

Dedicated hardware and transforms – Implementation, Constraint analysis for IPB computation, Motivational examples for IPB, General IPB computation, Sample period calculation, Parallel architecture, Odd-even register reuse, Power consumption, Pipelining, Pipelining FIR filter, Time-invariant systems, Valid pipelining examples, Feed forward cutsets, Balanced pipeline, Retiming basic concept, Example and uses of retiming.

Resource sharing: adder example, Changing iteration period, Hardware assumptions and constraint analysis, Mathematical formulation, Examples with formulation, Example: Biquad filter, Hardware architecture, Review biquad folding sets, Complete biquad hardware.

UNIT-III

Scheduling: Obtaining a folding schedule, ASAP schedule, Utilization Efficiency, ALAP schedule, Iteration period bound and scheduling, Retiming for scheduling, Blocked schedules, Overlapped schedules, improved blocked schedule, Allocation, Binding and Scheduling, Heuristic approaches to scheduling, Mathematical formulation, ILP formulation, List scheduling, Hardware model, Force Directed Scheduling.

UNIT-IV

Programmable Systems: Software Compilation, Optimization Examples, Loop optimizations, Software pipelining, FFT Optimization, CPUs and FPGAs, FFT on FPGA board, Understanding ELF files

UNIT-V

Memory and Communication Systems: On-chip communication basics, Many-to-Many communication, AXI bus handshaking, HW accelerator for FPGA, DMA and arbitration, Network-on-chip basics, NoC - topologies and metrics, NoC– routing, NoC - switching and flow control.

Specialized Architectures: Systolic Arrays – Background, CORDIC algorithm, Parallel implementation of FIR filters, Unfolding Transformation, Look ahead Transformation, Introduction to GPUs and Matrix multiplication

Text Books:

1. KK Parhi, “VLSI Digital Signal Processing Systems: Design and Implementation”, Wiley, NY, 1999.

2. Lars Wanhammar, Academic Press, 1999.

Reference Books:

1. Peter Pirsch, “Architectures for Digital Signal Processing”, 2nd edition, John Weily, 2007

2. B. Venkataramani and M. Bhaskar, “Digital Signal Processors, Architecture, Programming and Applications”, 2 Edition, TMH, 2004.

3. Jervis, “Digital Signal Processing- A practical approach”, 4th edition, Pearson Education, 2004.

<table>
<tr><th>Course Title</th><th colspan="5">RF System Design</th><th colspan="3">B. Tech ECE VII Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">2004706</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To learn the importance and issues in the design of RF
- To design RF filter and RF amplifier
- To study about the characteristics of oscillators, mixers, PLL, wireless synthesizers and detector

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand different RF Components such as Passive components, Microstrip Transmission Line.
CO 2	Design RF Amplifiers-High gain, Low gain Minimum Noise Amplifiers.
CO 3	Design of RF Oscillators.
CO 4	Design of RF Converters, Mixers.
CO 5	Design of Matching networks for RF Circuits.

UNIT-I

RF systems: basic architectures, Transmission media and reflections, Maximum power transfer, Passive RLC Networks - Parallel RLC tank, Q, Series RLC networks, matching, Pi match, T match, Passive IC Components, Interconnects and skin Effect, Resistors, capacitors, Inductors.

UNIT-II

Review of MOS devices, **Distributed Systems**- transmission lines, reflection coefficient, The wave equation, examples, Lossy transmission lines, Smith charts – plotting gamma.

High Frequency Amplifier Design - Bandwidth estimation using open-circuit time constants, Bandwidth estimation using short-circuit time constants, Rise time, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers ,tuned amplifiers, Cascaded amplifiers.

UNIT-III

Noise- Thermal noise, flicker noise review, Noise figure, **LNA Design -** Intrinsic MOS noise Parameters, Power match versus noise match, Large signal performance, design examples & Multiplier based mixers. **Mixer Design** – Sub sampling mixers.

UNIT-IV

RF Power Amplifiers - Class A, AB, B, C Amplifiers, Class D, E, F amplifiers, RF Power amplifier design examples.

Voltage controlled oscillators – Resonators, Negative resistance oscillators

UNIT-V

Phase locked Loops - Linearized PLL models, Phase detectors, charge Pumps, Loop filters, PLL design Examples. **Frequency synthesis and oscillators-** Frequency division, integer-N synthesis, Fractional frequency synthesis.

Phase noise - General considerations, Circuit examples. **Radio architectures** - GSM radio architectures, CDMA, UMTS radio architectures.

<u>Text Books:</u>

1. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2004.
2. Behzad Razavi, "RF Microelectronics", Prentice Hall, 1997.

<u>Reference Books:</u>

1. Ellinger, Frank, "Radio Frequency Integrated Circuits and Technologies", Springer, 2008.
2. Cam Nguyen, "Radio Frequency Integrated Circuit Engineering",John Wiley & Sons, 2015.

Course Title	**Low Power VLSI Design**					**B. Tech ECE VII Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2004707	**PEC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**

		3	-	--	3	40	60	100
Mid Exam Duration: 90Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To study the concepts of device behavior and modeling
- To study the concepts of low voltage, low power logic circuits.
- To identify the power dissipation mechanisms in various MOS logic styles
- To familiarize suitable techniques to reduce power dissipation, power optimization and power estimation.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand leakage sources and reduction techniques.
CO 2	Analyze power consumption and distribution in digital circuits.
CO 3	Apply Power minimization techniques in designing the low power circuits
CO 4	Design Low Power Memories

UNIT-I

Technology & Circuit Design Levels: Sources of power dissipation in digital ICs, degree of freedom, recurring themes in low-power, emerging low power approaches, dynamic dissipation in CMOS, effects of Vdd & Vt on speed, constraints on Vt reduction, transistor sizing & optimal gate oxide thickness, impact of technology scaling, technology innovations.

UNIT-II

Low Power Circuit Techniques: Power consumption in circuits, flip-flops & latches, high capacitance nodes, energy recovery, reversible pipelines, high performance approaches.

UNIT-III

Low Power Clock Distribution: Power dissipation in clock distribution, single driverVersus distributed buffers, buffers & device sizing under process variations, zero skew Vs.Tolerable skew, chip & package co-design of clock network.

UNIT-IV

Logic Synthesis for Low Power estimation techniques: Power minimization techniques, low power arithmetic components- circuit design styles, adders, multipliers.

UNIT V

Low Power Memory Design: Sources & reduction of power dissipation in memory subsystem, sources of power dissipation in DRAM & SRAM, low power DRAM circuits, low power SRAM circuits.

Text Books:

1. Jan M. Rabaey & Massous Pedram, “Low Power Design Methodologies”, KluwerAcademic, 2002
2. Kaushik Roy, Sharat Prasad, “Low power CMOS VLSI circuit design”, John WileysonsInc.,2000.
3. J.B.Kulo and J.H Lou, “Low voltage CMOS VLSI Circuits”, Wiley, 1999.

Reference Books:

1. A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”,Kluwer,1995
2. Gary Yeap, “Practical low power digital VLSI design”, Kluwer, 1998.

<table>
<tr><td>Course Title</td><td colspan="4">Bio-Medical Instrumentation</td><td colspan="3">B. Tech ECE VII Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004708</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To understand the functioning of Human Cell and its electrical characteristics.
- To get sufficient knowledge about cardiovascular measurement and circulatory System of heart
- To get familiarize with pace makers and Defibrillators
- To understand about the electrical hazards that may occur during the usage of medical instruments

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the functioning of Medical Instrumentation System, Human Cell and its electrical characteristics
CO 2	Describe Organization of cell, various potentials and bio-electrodes.
CO 3	Analyze the functioning of cardiovascular measurement and circulatory System of heart
CO 4	Apply protective mechanisms for Patient electrical safety

UNIT-I

Components of Medical Instrumentation System: Bio-amplifier, Static and dynamic characteristics of medical instruments. Bio-signals and characteristics. Problems encountered with measurements from human beings.

UNIT-II

Sources of Bioelectric Potentials: Resting and action Potentials, Propagation of Action Potentials, the bioelectric potentials, electrode theory, biopotential electrodes-micro electrodes, skin surface electrodes, needle electrodes, biochemical transducers-reference electrode, the pH electrode.

UNIT-III

The Cardiovascular System: The heart and Cardiovascular System, Electrocardiography, measurement of blood pressure, measurement of blood flow and cardiac output,Pacemaker, Defibrillator.

UNIT-IV

Measurements in the Respiratory System: The Physiology of the Respiratory System, Test and Instrumentation for Mechanics of Breathing, Gas exchange and Distribution, Respiratory therapy equipment.

Biotelemetry: Introduction to Biotelemetry, physiological parameters Adaptable to Biotelemetry, the components of biotelemetry system, Applications of telemetry in patient care.

UNIT-V

Electrical safety of medical equipment: Types of hazards, natural protective mechanism, leakage current, patient isolation, hazards in operation rooms, grounding conditions in hospital environment.

Text Books:

1. Biomedical Instrumentation and Measurements – Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, PHI, 2nd Ed, 1980.
2. Medical Instrumentation, Application and Design – John G. Webster, John Wiley, 3rd Ed., 1998.

Reference Books:

1. Principles of Applied Biomedical Instrumentation – L.A. Geoddes and L.E. Baker, John Wiley, 1975.
2. Hand-book of Biomedical Instrumentation – R.S. Khandpur, TMH, 2nd Ed., 2003.
3. Biomedical Telemetry – Mackay, Stuart R., John Wiley, 1968.
4. Biomedical Instrumentation- M. Armugam,Anuradha agencies publications.

Course Title	Radar and Satellite Communication					B. Tech ECE VII Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004709	PEC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	--	3	40	60	100
Mid Exam Duration: 90Min					End Exam Duration: 3Hrs			

Course Objectives:

- The goal of the course is to introduce students to the fundamentals of radar and satellite communication.
- To provide an understanding of the basic concepts, operation, and modern radar systems.
- To familiarize with basic concepts related to satellite Communication. Understand Sub-Systems of Satellites and Launches.
- To know about the parameters affecting the Satellite System Performance.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Apply Radar range equation for calculating various Radar parameters.
CO 2	Compare various radars and their characteristics.
CO 3	Describe the Orbital aspects of Satellite Communication.
CO 4	Describe Spacecraft, Earth station and Multiple access techniques.
CO 5	Design satellite links for specified C/N.

UNIT-I

Introduction to Radar: Introduction to radar, Radar block diagram and operation, Radar frequencies, Applications of radar, Radar range equation, Prediction of range performance, Minimum detectable signal, Receiver noise, Probability density function, SNR, Integration of radar pulses, Radar cross-section of targets, PRF and range ambiguities,

UNIT-II

Radar Technology: Doppler Effect, CW radar, FM CW radar, Multiple frequency CW radar. MTI radar-Delay line canceller, Range gated doppler filters, Blind speeds, Staggered PRF, Tracking radar-sequential lobing, conical scan, Monopulse: amplitude comparison and phase comparison methods, Radar displays.

UNIT-III

Orbital aspects of Satellite Communication: Introduction to geo-synchronous and geo-stationary satellites, Kepler's laws, Locating the satellite with respect to the earth, Sub-satellite point, Look angles, Mechanics of launching a synchronous satellite, Orbital effects, Indian scenario in communication satellites.

UNIT IV

Spacecraft and Earth station: Satellite subsystems- Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Spacecraft antennas, Multiple access techniques, comparison of FDMA, TDMA, and CDMA. Earth station equipments, tracking systems.

UNIT-V

Satellite link design: Introduction to satellite link design, basic transmission theory, system noise temperature and G/T ratio, design of downlink and uplink, design of satellite links for specified C/N

Text Books:

1. Merrill I.Skolnik, "Introduction to Radar Systems", 2nd edition-TMH 1980.
2. Pratt, John Wiley, "Satellite communications",3rd edition, 2019.
3. Dennis Roddy, "Satellite Communications", 2nd Edition, 1996

Reference Books:

1. Robert M.Gagliardi, - satellite communication systems, CBS Publications
2. M Richharia "Satellite Communication System", CBS Publications
3. K. K Sharma "Introduction to Radar Systems", 3rd edition.

<table>
<tr><td>Course Title</td><td colspan="5">Solid Waste Management</td><td colspan="3">B.Tech CE VI Sem (R20)</td></tr>
<tr><td>CourseCode</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE104</td><td rowspan="2">Open Elective (OEC II)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
To know the necessity of solid waste management
To study various strategies for the collection of solid waste
To understand various solid waste disposal methods
To understand how to categorize the Hazardous Wastes</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand and identify the physical and chemical composition of solid waste.</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand the optimum route planning for transport of solid waste.</td></tr>
<tr><td>CO 3</td><td colspan="8">Understand the techniques and methods used in transformation, conservation, and recovery of materials from solid wastes.</td></tr>
<tr><td>CO 4</td><td colspan="8">Understand the design of waste disposal systems.</td></tr>
<tr><td>CO 5</td><td colspan="8">Understand the sources and how to manage the different categories of Hazardous Wastes.</td></tr>
</table>

UNIT - I

Introduction to Solid Waste

Definition - Types of solid waste - sources of solid waste - Characteristics - properties of solid wastes - Sampling of Solid wastes - Elements of solid waste management

UNIT - II

Solid Waste Management

Solid waste generation - onsite handling - storage and processing - collection of solid wastes - Stationary container system and Hauled container systems - Route planning - transfer and transport.

UNIT - III

Resource and Energy Recovery

Processing techniques - materials recovery systems - Composting - types of composting - Problems with composing – Pyrolisis – Gasification - RDF - recovery of energy from conversion products - materials and energy recovery systems.

UNIT - IV

Landfills

Types and Construction of landfills - Design considerations - Life of landfills - Landfill Problems - Lining of landfills - Leachate pollution and control - Landfills reclamation.

UNIT - V

Hazardous Waste Management

Sources and characteristics - Effects on environment - Risk assessment - Disposal of hazardous wastes - Secured landfills, incineration - Biomedical waste disposal - E-waste management

Text Books:

1. Tchobanoglous G, Theisen H and Vigil SA 'Integrated Solid Waste Management, Engineering Principles and Management Issues' McGraw-Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, 'Solid Waste Engineering' Brooks/Cole Thomson Learning Inc., 2002.

Reference Books:

1. CPHEEO Manual on Municipal Solid Waste Management - 2000
2. Qian X, Koerner RM and Gray DH, 'Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.
3. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, 'Environmental Engineering', McGraw Hill Inc., New York, 1985.

<table>
<tr><td>Course Title</td><td colspan="4">Estimation and Costing</td><td colspan="3">B.Tech CE VI Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE105</td><td rowspan="2">Open Elective (OEC II)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
To attain basic knowledge on types of quantity estimation of structures different types of structures and estimate quantities of load bearing wall structures
To interpret the rates of different items of works involved in a construction activity.
To understand various types & conditions of contracts and related documentation
To know about various techniques of valuation of land and building properties
To get basic knowledge on various types of costing along with cost control and reduction techniques.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Estimate quantities of various types of load bearing wall structures.</td></tr>
<tr><td>CO 2</td><td colspan="8">Calculate the rates of different items of works involved in a construction activity.</td></tr>
<tr><td>CO 3</td><td colspan="8">Know different types of contract documents as per requirements of a project.</td></tr>
<tr><td>CO 4</td><td colspan="8">Do valuation of land and building properties.</td></tr>
<tr><td>CO 5</td><td colspan="8">Do costing of a product using various techniques.</td></tr>
</table>

UNIT-I

Introduction to the Estimation of Structures

Introduction, Different Item of Works – Units of Item of works– Types of Estimates – Methods of Estimates.

Quantity Estimation of Buildings

Estimation of Quantities in Buildings: Load Bearing Wall Structure of Single Room and Multi Room

UNIT – II

Rate Analysis

Rate Analysis of Different Item of Works: Earthwork Excavation – Mortars of Various Proportions(Cement and Lime)–Concrete with Various Proportions (Lime and Cement) – Brick Masonry – Stone Masonry – Pointing – Painting – Plastering.

UNIT – III

Contracts

Types of Contracts, Contract Document, Conditions of Contracts, Contract Procedure, Termination of Contracts, Specifications, Important Conditions of Contract, Arbitration and Tenders.

UNIT – IV

Valuation

Introduction, Technique of Valuation, Elements of Valuation and Factors Affecting Valuation, Methods of Valuation to the Land Property and Building Property, Mortgage.

UNIT – V

Costing

Fixed and variable cost, Product and Process Costing, Standard Costing, Cost estimation, Relevant Cost for decision making, Cost estimation, Cost control and Cost reduction techniques.

Text Books:

1. B N Dutta "Estimating and Costing in Civil Engineering", U B S Publishers Distributers Pvt. Limited, Noida.
2. "Standard Data Book – Vol.2", Andhra Pradesh Department of Standard Specifications,Amaravati.
3. Contracts and estimations by B.S.Patil, Universities.Press, Hyderabad
4. G.S. Birdie, Estimating and Costing, Danpatrai Publications, New Delhi, 2009
5. Riggs, J.L., Dedworth, Bedworth, D.B, Randhawa, S.U. Engineering Economics, McGraw Hill International Edition, 1996

Reference Books:

1. Dr. Roshan H Namavati "Professional Practice", The Lakhani Book Depot, Mumbai.
2. S C Rangwala "Estimating Costing and Valuation", Charotar Publishing House Pvt.Limited, Anand.
3. IS 1200 (Parts I to XXV–1974/ Method of Measurement of Building and Civil EngineeringWorks – B.I.S.)
4. M. Chakraborthi, Estimating Costing Specification and Valuation in Civil Engineering,23rd Edition, Laxmi Publications, New Delhi, 2010.

Course Title	Water Management					B.Tech CE VI Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE106	Open Elective (OEC II)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 1.5 Hrs						End Exam Duration: 3 Hrs		

Course Objectives:
To understand different watershed behavior
To be able to interpret runoff data and quantify erosion by using various modelling methods.
To understand land use classification and impact of land use changes on hydrological cycle parameters.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Know concept and need for watershed management.
CO 2	Aware on various causes of soil erosion and mitigation methods.
CO 3	Implement basic rain water harvesting methods.
CO 4	Understand artificial groundwater recharge methods.
CO 5	Understand the soil reclamation methods.

UNIT – I
Introduction
Concept of watershed, need for watershed management, concept of sustainable development, hydrology of small watersheds.

UNIT – II
Soil Erosion
Principles of soil erosion- causes of soil erosion, types of soil erosion, estimation of soil erosion from small watersheds, Control of soil erosion, methods of soil conservation – structural and non-structural measures.

UNIT – III
Water Harvesting
Principles of water harvesting, methods of rainwater harvesting, design of rainwater harvesting structures.

UNIT – IV
Ground Water Recharge
Artificial recharge of groundwater in small watersheds-, methods of artificial recharge.

UNIT – V
Reclamation of saline soils
Micro farming - biomass management on the farm.

Text Books:
1. Murthy, V.V.N. and M.K. Jha Land and Water Management, Kalyani Publishers, 2015
2. Watershed Management by Madan Mohan Das and M.D. Saikia, Prentice Hall of India, 2013.

3. Watershed Management Muthy, J. V. S., New Age International Publishers, 1998.

Reference Books:

1. Watershed Hydrology by P E Black, Prentice Hall Englewood Cliffs, 1991.
2. Watershed Hydrology by R Suresh, Standard Publishers and Distributors, Delhi, 2020

<table>
<tr><td>Course Title</td><td colspan="5">Energy Conversion Systems</td><td colspan="3">B. Tech. EEE
Open Elective - II</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE203</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1Hr30M</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to learn about energy conversion techniques, sources of electrical energy production and impact of energy conversion systems on environment.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand various energy conversion systems, fuel cells & batteries</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze solar and wind energy conversion process</td></tr>
<tr><td>CO 3</td><td colspan="8">Illustrate Ocean Energy Conversion systems</td></tr>
<tr><td>CO 4</td><td colspan="8">Explain the environmental effects of Energy Conversion Systems.</td></tr>
</table>

UNIT I

Photo Voltaic Power Generation: Spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, test specifications for PV systems.

UNIT II

Wind Energy Conversion: Power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

UNIT III

Tidal Power Station: Tides and Tidal power stations - modes of operation of Tidal project - Turbines and Generators for Tidal Power generation.

Ocean Thermal Energy Conversion: Types of ocean thermal energy conversion systems, Application of OTEC systems examples.

UNIT IV

Miscellaneous Energy Conversion Systems: Biomass conversion, Geothermal energy, Thermo electric energy conversion: Seebeck effect, Peltier and Thomson effects and their coefficients – Thermo-Electric Generator – Peltier Cooling

UNIT V

Fuel Cells & Batteries: Introduction - principles of EMF generation - description of fuel cells **-** Batteries, Description of batteries, Battery applications for large power.

Environmental Effects: Environmental Effects of Energy Conversion Systems, Pollution from coal and preventive measures - steam stations and pollution - pollution free energy systems.

Text Books

1. "Energy conversion systems" by Rakosh das Begamudre, New age international Private Ltd., publishers, 1^{st} Edition, 2000.
2. "Renewable Energy Resources" by John Twidell and Tony Weir, CRC Press (Taylor & Francis).

<table>
<tr><td>Course Title</td><td colspan="5">Smart Grid</td><td colspan="3">B. Tech. EEE
Open Elective - II</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE204</td><td rowspan="2">Open Elective Course (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1Hr30M</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The student is able to learn fundamentals, Architecture and analysis of smart grid with communication, networking and measuring technologies involved in it.</td></tr>
<tr><td colspan="9">On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the features, fundamental components and architecture of smart grid</td></tr>
<tr><td>CO 2</td><td colspan="8">Explain information, communication and networking technologies involved with the smart grid</td></tr>
<tr><td>CO 3</td><td colspan="8">Explain operation and importance of PMU, WAMPS and smart storage systems in smart grid</td></tr>
<tr><td>CO 4</td><td colspan="8">Analyze Microgrid with various concepts and challenges in future</td></tr>
</table>

UNIT-1

Introduction to Smart Grid: Working definitions of Smart Grid and Associated Concepts – Need of Smart Grid – Smart Grid Functions – Opportunities & Barriers of Smart Grid - Conventional Power Grid and Smart Grid -Concept of Resilient & Self-Healing Grid.

UNIT-II

Smart Grid Architecture: Components and Architecture of Smart Grid – Review of Proposed Architectures for Smart Grid – The Fundamental Component of Smart Grid Designs – Transmission Automation – Distribution Automation –Renewable Integration.

UNIT-III

Information and Communication Technology: Smart sensors, Wired and wireless communication Technology, Network Structures (**HAN, LAN, NAN, WAN**), Introduction to Smart Meters – Advanced Metering Infrastructure (AMI).

UNIT-IV

Smart Grid Technologies: Geographic Information System (GIS) - Intelligent Electronic Devices (IED) - Smart storage like Battery- SMES - Pumped Hydro - Compressed Air Energy Storage - Wide Area Measurement System (WAMS) – SCADA - Phase Measurement Unit (PMU).

UNIT – V

Micro grids and Distributed Energy Resources: Concept of micro grid, need & application of micro grid, formation of micro grid, Issues of interconnection, protection & control of micro grid, Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, and fuel cells.

Text Books

1. Janaka Ekanayake, Kithsir iLiyanage, Jian zhong. Wu, Akihiko Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.
2. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 1e,2013.
3. James Momoh, "Smart Grid: Fundamentals of Design and Analysis"- Wiley, IEEE Press, 2012.

Reference Books

1. A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer Edition, 2e, 2017.
2. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press.
3. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability", Artech House Publishers July 2011.
4. 4. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.

<table>
<tr><td>Course Title</td><td colspan="4">Automotive Electronics, Sensors & Drives</td><td colspan="4">B.Tech ME VI Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE306</td><td rowspan="2">OEC-II</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
. The objectives of this course are to
• Explain the use of electronics in the automobile.
• Explain the importance of various types of sensors and actuators in automotive electronics.
• Demonstrate the various control elements in Engine Management system.
• Familiarize with Vehicle management systems
• Identify various electronic and the instrumentation systems used in automobile</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Obtain an overview of automotive components, like sensors, actuators, communication protocols and safety systems employed in today’s automotive industry.</td></tr>
<tr><td>CO 2</td><td colspan="8">Interface automotive sensors and actuators with microcontrollers.</td></tr>
<tr><td>CO 3</td><td colspan="8">Know, the various display devices that are used in automobiles</td></tr>
<tr><td>CO 4</td><td colspan="8">Identify the elements in the engine management and vehicle management system.</td></tr>
<tr><td>CO 5</td><td colspan="8">Summarize an overview of automotive components, like sensors, actuators, communication protocols and safety systems employed in today’s automotive industry.</td></tr>
</table>

UNIT - I

Introduction to microcomputer

Introduction to microcomputer: Microcomputer: Buses, memory, timing, CPU registers; Microprocessor architecture: Initialization, operation codes, program counter, branch and jump instructions, subroutine. Analog to digital converters and Digital to analog converters, sampling, polling and interrupts, digital filters, lookup table.

UNIT - II

Sensors and actuators

Sensors and actuators: Speed sensors, Pressure sensors: Manifold Absolute Pressure sensor, knock sensor, Temperature sensors: Coolant and Exhaust gas temperature, Exhaust Oxygen level sensor, Position sensors: Throttle position sensor, accelerator pedal position sensor and crankshaft position sensor, Air mass flow sensor. Solenoids, stepper motors and relays.

UNIT - III

Electronic engine management system

Electronic engine management system: Electronic engine control: Input, output and control strategies, electronic fuel control system, fuel control modes: open loop and closed loop control at various modes, EGR control, Electronic ignition systems – Spark advance correction schemes, fuel injection timing control.

UNIT - IV

Electronic vehicle management system

Electronic vehicle management system: Cruise control system, Antilock braking system, electronic suspension system, electronic steering control, traction control system, Transmission control, Safety: Airbags, collision avoiding system, low tire pressure warning system.

UNIT - V

Automotive instrumentation system

Automotive instrumentation system: Input and output signal conversion, multiplexing, fuel quantity measurement, coolant temperature and oil pressure measurement, display devices- LED, LCD, VFD and CRT, Onboard diagnostics(OBD), OBD-II, off board diagnostics.

Text Books:

1. Understanding Automotive Electronics, William B Ribbens, Newne Butterworth-Heinermann, 6th edition 2003.

2. Crouse W H, Automobile Elctrical Equipment, McGraw Hill Book Co.Inc, Newyork 2005.

Reference Books:

1. Bechhold “Understanding Automotive Electronics”, SAE, 1998.

2. Robert Bosch “Automotive Hand Book”, SAE (5th Edition), 2000.

3. Tom Denton,”Automobile Electrical and Electronic Systems” 3rd edition- Edward Arnold, London - 2004.

4. Eric Chowanietz - ‘Automotive Electronics’ - SAE International USA – 1995.

Course Title	Robotics and Applications in Manufacturing					B.Tech ME VI Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE307	OEC-II	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	--	3	40	60	100
Mid Exam Duration: 90 Minutes						End Exam Duration: 3Hrs		

Course Objectives:

. The objectives of this course are to

- Learn the fundamental concepts of industrial robotic technology.
- Apply the basic mathematics to calculate kinematic and dynamic forces in robot manipulator.
- Understand the robot controlling and programming methods.
- Describe concept of robot vision system.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Illustrate the industrial applications of robot vision system.
CO 2	Use concepts of robot controlling systems.
CO 3	Evaluate D-H notations for simple robot manipulator.
CO 4	Define a robot and homogeneous transformations.
CO 5	Apply the concepts of robot.

UNIT - I

Fundamentals of Robots

Fundamentals of Robots: Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots. Introduction to matrix representation of a point in a space a vector in space, a frame in space, Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis.

UNIT - II

Kinematics of robot, Differential motions and Velocities

Kinematics of robot: Forward and inverse kinematics of robots- forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, The inverse kinematic of robots, Degeneracy and Dexterity, simple problems with D-H representation.

Differential motions and Velocities: Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

UNIT - III

Control of Manipulators

Control of Manipulators: Open- and Close-Loop Control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID Control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

UNIT - IV

Robot Vision

Robot Vision: Introduction, architecture of robotic vision system, image processing, image acquisition camera, image enhancement, image segmentation, imaging transformation, Camera transformation and calibrations, industrial applications of robot vision.

UNIT - V

Robot Application in Manufacturing

Robot Application In Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text books:

1. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,NicholasG.Odrey , Industrial Robotics — McGraw Hill, 1986.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.
3. John.J. Craig Addison, Introduction to Robotics: Mechanics and Control, Wesley, 1

Reference Books:

1. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
2. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1st Edition Wiley-Interscience, 1986.
3. Robert J. Schillin, Fundamentals of Robotics: Analysis and control, Prentice-Hall Of India Pvt. Limited, 1996.
4. Mohsen shahinpoor, A robot Engineering text book, Harper & Row Publishers,1987.

<table>
<tr><td>Course Title</td><td colspan="5">Sensors in Intelligent Manufacturing</td><td colspan="3">B.Tech ME VI Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE308</td><td rowspan="2">OEC-II</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

. The objectives of this course are to

- Familiarize the sensors used in intelligent manufacturing.
- Illustrate sensors used in precision manufacturing and CNC machine tools.
- Explain sensors for monitoring of manufacturing systems.
- Outline advanced sensors used in intelligent manufacturing.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Classify various sensors used in intelligent manufacturing.
CO 2	Summarize sensors used in computer integrated manufacturing and machine sensors.
CO 3	Apply sensors used in precision manufacturing.
CO 4	Identify reasons behind machinery faults.
CO 5	Develop the Important role in making the products intelligent and highly automatic.

UNIT - I

Introduction

Introduction –Principles, classifications and characteristics of sensors – Electrical, magnetic, optical, acoustic, pneumatic, magnetic, electro-optical and vision sensors, role of sensors in intelligent manufacturing.

UNIT - II

Sensors and control in CIM and FMS:

Sensors and control in CIM and FMS: Design of CIM, decision support system for CIM, analysis of CIM, development of CIM strategy with sensors and control. FMS-Robot control with machine vision sensors-Architecture of robotic vision system, image processing, image acquisition, enhancement, segmentation, transformation, industrial application of robot vision, multi Sensor controlled robots, measurement of robot density, robot programming.

UNIT - III

Sensors in Precision Manufacturing:

Sensors in Precision Manufacturing: Testing of manufacturing components, principles and applications of digital Encoders, opto-electronic colour sensors, control applications in robotics. Sensors for CNC machine tools– linear, position and velocity sensors. Automatic identification techniques for shop floor control.

UNIT - IV

Sensors for Monitoring of Manufacturing Systems

Sensors for Monitoring of Manufacturing Systems: Principles – sensors for monitoring temperature, force, vibration and noise. Sensors to detect machinery faults.Selection of sensors and monitoring techniques.

UNIT - V

Smart / Intelligent sensors

Smart / Intelligent sensors: Integrated sensors, micro sensors, nano sensors. Manufacturing of semi conductor sensors.Fibre optic sensors – Fibre optic parameters, configurations, photoelectric sensor for long distance, sensor alignment techniques.

Text Books:

1. SabrieSoloman, Sensors and Control systems in Manufacturing, McGraw-Hill, 2/e, 2010.

2. H.K Tonshoff and I.Inasaki, Sensor Applications Vol 1: Sensors in Manufacturing, Wiley-VCH Publications, 2001.

Reference Books:

1. SabrieSoloman, Sensors Handbook, McGraw-Hill, 2/e, 2010.

2. MikellP.Groover, Mitchell Weiss, Roger N.Nagel, Nicholas G.Odrey, Industrial Robotics, Tata McGraw-Hill, 2008.

<table>
<tr><td>Course Title</td><td colspan="4">Non-Conventional Energy Sources</td><td colspan="4">B.Tech ME VI Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE309</td><td rowspan="2">OEC-II</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

. The objectives of this course are to

- To get exposure on solar radiation and its environmental impact to power production
- To know about the various collectors used for storing solar energy and their applications
- To learn about the wind energy and biomass and its economic aspects
- To know about geothermal, Ocean and Wave energy sources
- To know about direct energy conversion systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Determine the physics of solar radiation and its measurement techniques.
CO 2	Classify the solar energy collectors, methodologies of storing solar energy and
CO 3	Apply knowledge to develop Wind and Bio-energy systems.
CO 4	Categorize the Geothermal, Tidal, OTEC and hydelenergy, its mechanism of production and its applications.
CO 5	Illustrate the concepts of Direct Energy Conversion systems and their applications.

<u>UNIT - I</u>

Principles of Solar Radiation

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surfaces, instruments for measuring solar radiation and Sunshine Recorder, solar radiation data.

<u>UNIT - II</u>

Solar Energy Collection, Storage& Applications

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, Advantages and disadvantages of concentrating collectors over Flat plate collectors

Solar Energy Storage: Different methods of solar Thermal Energy Storage Sensible, latent heat and stratified storage, solar ponds.

Applications of Solar Energy: solar water heating, solar distillation and drying, photovoltaic energy conversion.

<u>UNIT – III</u>

Wind Energy & Bio-Mass Energy

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engineoperation and economic aspects.

UNIT – IV

Geothermal Energy &Energy from Oceans

Geothermal sources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Basic Principles utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave energy: Potential and conversion techniques, mini-hydel power plants

UNIT – V

Direct Energy Conversion Systems:

Need for DEC, principles of DEC, Thermo-electricpower generation – Basic Principle, materials, applications, MHD Power Generation-Principle, MHD systems, Fuel cells-principle and operation, types of fuel cells and their applications

Textbooks:

1. Mehmet Kanoglu, YunusA. Cengel, John M. Cimbala, Fundamental and Applications of Renewable Energy, First Edition, McGraw Hill, 2020
2. John Twidell and Tony Weir, Renewable Energy Resources, Third Edition, Routledge, 2015
3. G.D. Rai, Non-Conventional Energy Sources, Sixth Edition, Khanna Publications, 2017

Reference Books:

1. Wendell H. Wiser, Energy Resources: Occurrence,
2. Sukhatme S.P. Nayak.J. P, ‘Solar Energy – Principle of Thermal Storage and Collection”, Tata McGraw Hill, 2008.
3. Wei Tong, Wind Power Generation and Wind Turbine Design, WIT Press,2010.

<table>
<tr><th>Course Title</th><th colspan="4">Supply Chain Management</th><th colspan="3">B.Tech ME VI Sem</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">20OE310</td><td rowspan="2">OEC-II</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:
. The objectives of this course are to
- Explain the basics of supply chain management.
- Familiarize inventory management techniques and models to ensure EOQ batch size under risk management.
- Demonstrate various distribution strategies for shipment of products.
- Focus on evaluating of strategic alliance partners and understanding of RDBMS.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Apply the concepts of supply chain management for demand forecasting.
CO 2	Use of SCM and inventory management for procurement.
CO 3	Analyze the shipment activities and related issues.
CO 4	Build third party alliances.
CO 5	Adapt the RDBMS data for communications and analyzing future challenges and understand e-commerce strategies

UNIT - I

Understanding the supply chain

Understanding the supply chain: What is SCM? Why SCM? The Complexity, Key issues in SCM Logistics network - Introduction, Data Collection, Transportation, Ware house Management, Demand forecasting, Role of aggregate planning, MRP, ERP.

UNIT - II

Inventory management

Inventory management: Concepts of Materials Management, Economic lot size model, Effect of Demand uncertainly, Fixed order costs, Variable lead frames, Inventory under certainly & uncertainty.

UNIT - III

Distribution strategies

Distribution strategies: Introduction, Centralized vs Decentralized control, Direct shipment, Cross Docking, Push based vs Pull based supply chain.

UNIT - IV

Strategic alliances

Strategic alliances: Third party Logistics (3PL), Retailer – supplier relationship issues, requirements, success & failures, Distributor integration Types & issues.

UNIT - V

MIS & SCM

MIS & SCM: Relational Data Base Management (RDBMS), System Architecture, Communications, and Implementation of ERP, Decision support systems for SCM: e-Commerce strategies and world class supply chain management.

Text Books:

1. Sunil Chopra, Peter Meindl, Supply Chain Management: Strategy, Planning, and Operation, 4/e, Pearson, 2010.

2. David N. Burt, Donald W. Dobler , World Class Supply Management: The Key to Supply Chain Management, 2/e, McGraw-Hill/Irwin, 2003.

3. Nabil Abu el Ata, Rudolf Schmandt , Essentials of Supply chain management; Westland Publications. (2016),

Reference Books:

1. John Joseph Coyle, Edward J. Bardi, C. John Langley, The Management of Business Logistics: A Supply Chain Perspective, South-Western/Thomson Learning, 2003.

2. UpendraKachru ,Logistics and Supply Chain Management, Excel Books, 2009.

3. D. K .Agarwal, Supply Chain Management with efficient Logistics , MACMILAN 2019.

Course Title	Introduction to VLSI					Open Electives		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE403	OE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	40	60	100
Mid Exam Duration: 90Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To introduce the concepts of IC fabrication technologies.
- To understand scaling techniques of CMOS devices and their effects.
- To study the methods to design the basic Gate level designs and draws their corresponding Layouts.
- To provide basic idea of Subsystem design, PLDs and CMOS testing.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand the operation of a MOS transistor down to the physical level.
CO 2	Implement various logic gates and circuits using MOS transistors.
CO 3	Analyze PLD and FPGA families for logic design.
CO 4	Analyze various CMOS testing schemes.

Unit-I

Introduction to VLSI: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & Bi CMOS technologies- Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation.

Unit-II

Basic Electrical Properties: Basic Electrical Properties of MOS Circuits: Ids Vs Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit, Pass transistor, NMOS Inverter, CMOS Inverter analysis and Bi-CMOS Inverters.

Unit-III

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2μ CMOS Design rules for wires, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

Unit-IV

Subsystem Design: Basic circuit concepts: Sheet resistance, area capacitance and delay calculation, Subsystem Design, Shifters, Adders, ALUs, Multipliers, High Density Memory Elements.

Unit-V

Semiconductor IC Design and CMOS testing: PLAs, FPGAs, CPLDs, Standard Cells, ach. CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Layout Design for improved Testability.

Text Books:

1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, Essentials of VLSI circuits and systems, PHI, 2005 Edition.

2. Weste and Eshraghian, Principles of CMOS VLSI Design, Pearson Education, 1999.

Reference Books:

1. John .P. Uyemura, Introduction to VLSI Circuits and Systems, JohnWiley, 2003.
2. Wayne Wolf, Pearson Education, Modern VLSI Design, 3rd Edition, 1997.
3. S.M. SZE, VLSI Technology, 2nd Edition, TMH, 2003.

<table>
<tr><td>Course Title</td><td colspan="4">Principles of communication systems</td><td colspan="3">Open Electives</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE404</td><td rowspan="2">OE</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To understand the Basics of Telecommunication Engineering.
• To introduce the Elements of Telecommunication systems.
• To provide Knowledge about various communication systems</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the fundamental concepts of Telecommunication Engineering.</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand use of different modulation techniques used in Analog and Digital Communication.</td></tr>
<tr><td>CO 3</td><td colspan="8">Understand different Telecommunication systems like Satellite communication, Optical Fiber communication, Wireless communication, Mobile communication etc. and its applications.</td></tr>
<tr><td>CO 4</td><td colspan="8">Compare and contrast advantages and limitations of various Telecommunication systems.</td></tr>
</table>

Unit I

Basics of Telecommunication Engineering: Definition of Telecommunication, Examples of telecommunications and evolution, various types of telecommunication systems such as telephone network, Radio broadcasting system, Computer networks, Internet.

Unit II

Basic Elements of Telecommunication systems General Block schematic of communication system, Communication channels, Analog versus digital communication systems, Need of modulation, Types of analog modulation such as AM and FM, Types of digital modulation such as Pulse code modulation, delta modulation, Continuous wave modulation such as ASK, FSK, PSK.

Unit III

Introduction to Optical Fiber Communication: Use of optical fiber in communication, Principle and working of OFC system, Block diagram, Types of optical fibers, various elements required in designing OFC system, Applications such as long distance transmission links, Computer communication networks.

Unit IV

Introduction to Satellite Communication: Use of satellite in telecommunications, Launching of Satellite from earth station, Types of satellite orbits, Classification of satellite according to applications, Satellite communication link block diagram.

Unit V

Some concepts in Wireless communications: Wireless Standards: Overview of 2G and 3G, 4G cellular standards, Multiple access schemes-FDMA, TDMA, CDMA and OFDM, Modulation schemes- BPSK, QPSK. GSM, Wi-Fi & Wi-Max, Bluetooth, Recent Trends/Developments.

Text Books:

1) Simon Haykin," Communication Systems", 4th Edition, John Wiley Publication.

2) George Kenndey, " Electronics Communication systems", 4th Edition

3) John G. Proakis," Digital Communication", Tata McGraw Hill

4) T . Prat, C.W. Bostian," Satellite Communication", Wielly Publication

Reference Books:

1. S. Rappaport," Wireless communication – Principles and Practice", Pearson Education.
2. John M. Senior,"Optical Fiber Communication Principles and Practice",, Pearson Education.

<table>
<tr><td>Course Title</td><td colspan="5">Java Programming (Open Elective Course-II)</td><td colspan="3">B. Tech VI Sem (R20) CSE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE503</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 90 Mins</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To give the students a firm foundation on Java concepts like Primitive data types, Java control flow, Methods, Object-oriented programming, Core Java classes, packages and interfaces, multithreading.
- To provide the students with an understanding of Java applets, Abstract Window, Toolkit and exception handling.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Solve problems using object oriented approach and implement them using Java.
CO 2	Develop efficient programs with multitasking ability and handle exceptions.
CO 3	Develop user friendly interface.
CO 4	Create AWT components.

UNIT - I

Object Oriented Programming basics: Need for OOP paradigm, Principles of OOP concepts

Java Basics: History of Java, Java buzzwords, Simple java program, classes and objects – concepts of classes, objects, constructors, methods, introducing access control, **this** keyword, overloading methods and constructors.

UNIT - II

Inheritance: Hierarchical abstractions, Types of Inheritance, benefits of inheritance, **super** uses, using **final** with inheritance, polymorphism- method overriding, abstract classes.

Packages and Interfaces: Defining, Creating and Accessing a Package, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT - III

Exception handling: Concepts of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, creating own exception sub classes.

UNIT - IV

Event Handling : Events, Event sources, Event classes, Event Listeners, The AWT class hierarchy, user interface components- Labels, Button, Scrollbars, Text Components, Check box, Choices, Layout manager types – Flow, Border, Grid, Card and Grid bag.

UNIT - V

Applets: Concepts of Applets, differences between applets and applications, life cycle of an Applet, creating applets, passing parameters to applets.

Swings: Icons and Labels, text fields, JButton class, Check boxes, Radio buttons, Combo boxes, and Tables.

Text Books:

1. Java; the complete reference, 7th editon, Herbert schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.
3. An Introduction to programming and OO design using Java, J.Nino and F.A.Hosch, John wiley & sons.
4. An introduction to Java programming and object oriented application development, R.A. Johnson-Thomson.

Reference Books:

1. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, eighth Edition, Pearson Education.

2. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, eighth Edition, Pearson Education.

3. Object Oriented Programming through Java, P. Radha Krishna, University Press.

4. Java and Object-Oriented programming Paradigm, Debasish Jana, PHI Learning Pvt. Ltd.

<table>
<tr><td>Course Title</td><td colspan="4">Web Designing
(Open Elective Course-II)</td><td colspan="3">B. Tech VI Sem (R20) CSE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE504</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Mins</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:
- To learn the basic principles of Web page design.
- To learn the basic concepts of HTML.
- To introduce client side scripting with Java Script.
- To introduce the concepts of CSS and Web publishing.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define the principle of Web page design and basics in web design.
CO 2	Visualize the basic concept of HTML and recognize the elements of HTML.
CO 3	Understand java Script and create static web pages.
CO 4	Introduce basics concept of CSS.
CO 5	Develop the concept of web publishing.

UNIT – I

Web Design Principles: Basic principles involved in developing a web site, Planning process, Five Golden rules of web designing, Designing navigation bar, Page design ,Home Page Layout, Design Concept.

Basics in Web Design: Brief History of Internet, What is World Wide Web, Why create a web site, Web Standards, Audience requirement.

UNIT – II

Introduction to HTML: What is HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags.

Elements of HTML: Introduction to elements of HTML, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.

UNIT – III

Java Script: Introduction, Basics of Java Script, Control Structures, Pop up Boxes, Functions, Arrays Events, Objects, Dynamic HTML.

UNIT – IV

Introduction to Cascading Style Sheets: Concept of CSS , Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts) , Working with block elements and objects, Working with Lists and Tables, CSS Id and Class , Box Model(Introduction, Border properties, Padding Properties, Margin properties) , CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Color , Creating page Layout and Site Designs.

UNIT – V

Introduction to Web Publishing or Hosting: Creating the Web Site, Saving the site, working on the web site, Creating web site structure, Creating Titles for web pages, Themes-Publishing web sites.

Text Books:

1. Creating a Web Page and Web Site College, 2002, Murray, Tom/Lynchburg.
2. HTML 5 in simple steps Dreamtech Press, Kogent Learning Solutions Inc.
3. A beginner's guide to HTML NCSA,14th May,2003.

Reference Books:

1. HTML, XHTML, and CSS Bible, 5ed, HTML, XHTML, and CSS Bible, 5ed, Wiley India.
2. Beginning HTML, XHTML, CSS, and JavaScript by John Duckett, Wiley India.
3. Beginning CSS: Cascading Style Sheets for Web Design by Ian Pouncey, Richard York, Wiley India.

<table>
<tr><td>Course Title</td><td colspan="4">OPERATING SYSTEMS
(Open Elective Course – II)</td><td colspan="4">B.Tech. VI Sem (R20UG) AI&ML</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE3903</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- Have an overview of functions of operating systems.
- Have a thorough knowledge of process management and memory management.
- To have a thorough knowledge of how handle to deadlocks.
- Learn the concepts of files, protection and security

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Understand the basic concepts related to the operating systems
CO2	Analyze the various process scheduling algorithms and process synchronization mechanisms.
CO3	Analyze the various memory management schemes.
CO4	Understand the ways to deal the deadlocks and the basic concepts related to files in the system.
CO5	Analyze the protection and security mechanism.

UNIT – I

Operating Systems Basics: Operating systems functions, Overview of computer operating systems, distributed systems, operating system services and systems calls, system programs, operating system structure.

UNIT – II

Process Management: Process concepts, scheduling-criteria, CPU scheduling algorithms, Evaluation of Scheduling Algorithms.

Concurrency: Process synchronization, the critical-section problem, Peterson's Solution, semaphores, Classic problems of Synchronization, monitors.

UNIT – III

Memory Management: Introduction**,** Swapping, contiguous memory allocation, paging,structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, Allocation of frames.

UNIT – IV

Deadlocks: system model, deadlock characterization, deadlock prevention,detection and avoidance, recovery form deadlock.

Files: The concept of a file, Access Methods, File Allocation Methods.

UNIT – V

Protection: Protection, Goals of Protection, Principles of Protection, Domain of protection Access Matrix, Implementation of Access Matrix.

Text Books:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating SystemConcepts", Eighth edition, John Wiley.

2. Andrew S Tanenbaum, "Modern Operating Systems", Fourth Edition, PearsonEducation.

3. William Stallings, "Operating Systems: Internals and Design Principles", SixthEdition2009, Pearson Education.

4. D.M. Dhamdhere, "Operating Systems, A Concept based Approach", Third Edition,TMH.

Reference Books:

1. A.S. Godbole, "Operating Systems", Second Edition, TMH.

2. Operating Systems: A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition.

3. Operating Systems – H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson.

4. Operating Systems: A Practical Approach, Rajiv Chopra, 4^{th} Edition, S Chand Publishers.

<table>
<tr><td>Course Title</td><td colspan="4">DATABASE MANAGEMENT SYSTEMS
(Open Elective Course – II)</td><td colspan="4">B.Tech. VI Sem (R20UG) AI&ML</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE3904</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>ContinuousInternal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To study the physical and logical database designs, database modeling, relational hierarchical, and network models.
- To understand and use data manipulation language to query, update, andmanaging the database.
- To develop an understanding of essential DBMS concepts such as: database secure integrity and concurrency.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	To understand the basic concepts and the application of Database systems.
CO 2	To understand the basics of SQL and construct queries using SQL.
CO 3	To understand the Relational Database design principles.
CO 4	To apply various Normalization techniques for database design improvement.
CO 5	To apply concurrency control and recovery techniques during transaction execution.

UNIT – I

Introduction - Database-System Applications, View of Data, Database languages, Database architecture, Database Users and Administrators.
E-R Model - The Entity Relationship Model, Constraints, Entity Relationship Diagrams, and Extended E-R features.

UNIT – II

Relational Model - Structure of Relational Databases, Database Schema, Keys, QueryLanguages, Fundamental Relational Algebra Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations, Modification of Database.

UNIT – III

Introduction to SQL - Data Definition, Basic Structure of SQL Queries, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Complex queries, views, Modification of the Database.
Advanced SQL -Integrity Constraints, Dynamic SQL, Functions and Procedures.
OtherRelational Query Languages - Tuple Relational Calculus, Domain Relational calculus.

UNIT – IV

Normal Forms – Atomic domain and First Normal Form, Keys and Functional Dependencies, Second Normal Form, BCNF, BCNF and Dependency Preservation, Third Normal Form, Lossless Decomposition, Dependency- preserving, Multi valued Dependencies, Fourth Normal Form, Join Dependencies, Fifth Normal Form, and Inclusion dependencies.

UNIT – V

Transactions -Transaction Concept, Transaction State, Implementation of TransactionAtomicity and Durability, Concurrent Executions, Serializability.

Concurrency Control -Lock-Based Protocols, Timestamp-Based Protocols.
RecoverySystem - Failure Classification, Storage, Recovery and Atomicity, Log based recovery.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan,” Database system Concepts”, 5thEdition, McGrawhill.

2. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", PearsonEducation, 3rd Edition, 2003

3. C.J.Date, “Introduction to Database”, 8 Th Edition, 2003, Addison-Wesley publication.

4. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States 1st Edition, 2000

Reference Books:

1. Raghurama Krishnan, Johannes Gehrke, Data base ManagementSystems.3rd Edition, Tata McGrawHill.

2. Peter Rob, Ananda Rao and Carlos Corone, Database Management Systems,Cengage Learning, 1st Edition, 2011.

3. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management,6th Edition,2012.

4. S.K.Singh, “Database Systems Concepts, Design and Applications”, First Edition,Pearson Education, 2006.

Reference Links:

1. https://nptel.ac.in/courses/106/105/106105175/ (IIT KHARAGPUR)

2. https://nptel.ac.in/courses/106/106/106106095/ (IIT MADRAS)

<table>
<tr><td>Course Title</td><td colspan="5">MATHEMATICAL STATISTICS FOR DATA SCIENCE & DATA ANALYTICS (R20)</td><td colspan="3">B. Tech.
Open Elective-II</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE603</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 minutes</td><td colspan="4">End Exam Duration: 3Hours</td></tr>
<tr><td colspan="9">Course Objectives:
• To help the students in getting a thorough understanding of the fundamentals of probabilities.
• To help the students in getting a thorough understanding and usage of statistical techniques like testing of hypothesis.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand and calculate the measures of dispersion</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze probability concepts</td></tr>
<tr><td>CO 3</td><td colspan="8">Apply distributions in real life problems.</td></tr>
<tr><td>CO 4</td><td colspan="8">Justify hypothesis concepts</td></tr>
<tr><td>CO 5</td><td colspan="8">Estimate correlation and regression coefficients</td></tr>
</table>

UNIT I:
Introduction, Mean, Median, Mode, Skewness, Range

Learning Outcomes:
At the end of this unit, the student will be able to
- understand and calculate the measures of dispersion

UNIT II:
Probability Basics, Simple probabilities, Rule of addition, Rule of multiplication, Conditional Probability, Baye's theorem.

Learning Outcomes:
At the end of this unit, the student will be able to
- analyze probability concepts

UNIT III:
Explaining basic concepts of Random Variables (Without Problems)- Probability Distributions: Binomial distribution**,** Poisson distribution**,** Normal distribution**,** Real life problems

Learning Outcomes:
At the end of this unit, the student will be able to
- apply distributions in real life problems.

UNIT IV:
Introduction, Hypothesis, Level of Significance, Type I and Type II errors, Confidence intervals for large Samples (only means and Proportions), Calculating sample size and power.
Learning Outcomes:

At the end of this unit, the student will be able to
- justify hypothesis concepts

UNIT V:
Introduction, Linear Regression, Correlation coefficient, Coefficient of determination, Root Mean Square Error.

Learning Outcomes:
At the end of this unit, the student will be able to
- estimate correlation and regression coefficients

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-42 edition.
2. Statistical Methods by S.P.Gupta, S Chand Publications
3. Probability and Statistics for Engineers, Johnson, Fifth edition, Prentice Hall of India.
4. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9^{th} edition-2013.

Reference Books:

1. Probability and Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publishers.
2. Probability and Statistics for Engineers and Scientists, Walpole and Myers, Seventh edition, Pearson Education Asia, 2002
3. An Introduction to Probability theory and its applications, William Feller
4. Engineering Mathematics by Srimanta Pal, Subodh C. Bhunia, Oxford University Press.

Course Title	**BASICS OF ELECTRICAL, MAGNETIC AND OPTOELECTRONIC MATERIALS**					**OPEN ELECTIVE- II**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE608	**BSC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End lab Exams**	**Total**
		3	**0**	**0**	**3**	40	60	100
					End Exam Duration: 3Hrs			

COURSE OBJECTIVES:

1.Students will be able to understand the fundamental concepts and applications of electrical, magnetic and optical properties of materials.
2.Apply a multi-disciplinary approach to plan, design, identify and address future needs of all the conventional and novel materials utilizing their properties for the society.

COURSE OUTCOMES: Upon completion of this course, the student will be able to:

CO1	**Obtain** knowledge about the electrical, magnetic and optoelectronic materials, their properties and applications
CO2	Successfully **apply** advanced concepts of materials engineering for the design, development and analysis of materials and devices.
CO3	**Develop** novel materials from the fundamental understanding of materials and apply them to societal needs.
CO4	**Analyze** the properties of superconductors.
CO5	**Identifies** the Engineering applications of electrical, magnetic and optoelectronic materials.

Unit – I: Electrical Materials

Introduction to electrical conduction–Dielectric constants – dielectric loss, dielectric breakdown, piezoelectricity and pyroelectricity.

Unit – II: Magnetic Materials

Introduction to dia, para, ferro, antiferro and ferri magnetism –Hysteresis loop–hard and soft magnetic materials- applications

Unit – III: Semiconducting Materials

Introduction to semiconducting materials – concept of doping – working principle of p-n junction diode, LED, Photo diode– solar cell – applications.

Unit – IV: Superconducting

Introduction to superconductors-Properties-Meissner effect-Type-1 &Ttype-II superconductors –BCS theory- high critical temperature (Tc)-applications.

Unit – V: Optoelectronic Materials

Introduction to Laser Principles – ruby, CO_2 lasers – applications of optoelectronic materials – introduction to optical fibers – light propagation –Fiber optic sensors-applications.

Text Books:

1. C. Kittel, Introduction to Solid State Physics, John Wiley and Sons, 7th edition,New Delhi, (2004).
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company

Reference Books:

1. V. Raghavan, Materials Science and Engineering, Prentice Hall of India, 5th edition, New Delhi, (2013).
2. B. G. Yacobi, Semiconductor Materials: An Introduction to Basic Principles, Springer, 1st edition, New York, (2013).
3. S. Kasap and P. Capper (eds.), Handbook of Electronic and Photonic Materials, Springer, New York, (2007).

<table>
<tr><td>Course Title</td><td colspan="5">Corrosion and Control</td><td colspan="3">B. Tech.
(Open elective-II)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE609</td><td rowspan="2">Open Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To review the fundamental aspects of electrochemistry.
• It also focuses on various forms of corrosion, and their impact on life of metallurgical components, means and ways to engineer corrosion</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Recall the concepts of corrosion and its mechanism.</td></tr>
<tr><td>CO 2</td><td colspan="8">Explore different forms of corrosion and its mechanisms & prevention methods.</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze different factors which influence corrosion in different medium</td></tr>
<tr><td>CO 4</td><td colspan="8">Identify different control methods for efficient control of corrosion</td></tr>
<tr><td>CO 5</td><td colspan="8">Discuss corrosion aspects which will enable them to apply for modern engineering technology</td></tr>
</table>

Unit-1: Introduction

Introduction to corrosion, definition and types of Corrosion (Chemical- & Electrochemical Corrosion-Evolution of Hydrogen gas & Absorption of Oxygen) & its mechanisms, Pilling Bed worth Rule , Galvanic series & its applications, Factors influencing corrosion-Metal & environment..

Learning Outcomes:

At the end of the unit, The students will be able to

- Explain the types of corrosion.
- Identify the factors which influence corrosion.

Unit-2: Corrosion& Various phenomenon

Uniform Corrosion (definition, mechanism & prevention), Galvanic (Two-metal) Corrosion (Definition, mechanism & prevention), Pitting corrosion (Definition, mechanism & prevention), Concentration Cell Corrosion (Definition, mechanism & prevention),Differential aeration method (Definition, mechanism & prevention)

Learning Outcomes:

At the end of the unit, The students will be able to

- Explain the mechanisms and prevention methods of different forms of corrosion.
- Analyze the differences between pitting and galvanic corrosion.

Unit-3: Environmental Factors on Corrosion

Various factors that influence Corrosion- Corrosion in water and aqueous solution, microbiologically induced corrosion, corrosion in acidic and alkaline medium.

Learning Outcomes:
At the end of the unit, The students will be able to

- discuss various environmental factors which influence the corrosion

Unit-4: Prevention & Control
Basic principle & concepts of prevention of corrosion-Cathodic protection (Sacrificial anodic protection, Impressed current Cathodic protection), Electroplating & Electroless plating-Definition with examples (Nickel & Copper), advantages - Alternation of Environment.

Learning Outcomes:
At the end of the unit, The students will be able to

- explain the prevention methods of corrosion
- discuss the basic concepts of electroplating and electroless plating

Unit-5: Modern theory and applications of corrosion:

Introduction, Gibb's free energy, cell potentials, EMF series, Corrosion rate expressions, Importance of corrosion in engineering technology & industrial applications.

Learning Outcomes:
At the end of the unit, The students will be able to

- Analyze the rate of corrosion
- Explain the importance of Electrochemical series

Textbooks:
1. Text Book of Engineering Chemistry, Shashi Chawla, Dhanapath Rai Publications, New Delhi, 4th Edition, 2011.
2. Corrosion of metals, Helmut Kaesche, Springer Publications
3. Handbook of Corrosion Engineering, 3rd edition, Pierre R. Roberg, McGraw Hill publications
4. General Chemistry for Engineers, Jeffrey S. Gaffney & Nancy A. Marley, Elsevier publications

REFERENCES:
1. Corrosion engineering, Fontana Mars G, Mc Graw Hill publications
2. A Text Book of Engineering Chemistry, Jain and Jain, Dhanapath Rai Publishing Company, New Delhi, 15th Edition, 2010
3. Corrosion and chemical resistant masonry materials Handbook, Walter T.V. Sheppard Lee, Building materials series.
4. General chemistry by Ebbing Darrell, Himalaya Publications

Course Title	Academic Writing					OPEN ELECTIVE – III		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE615	**HUM**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

COURSE OBJECTIVES	
1	Demonstrate and apply knowledge of basic essay structure, including introduction, body and conclusion;
2	Employ the various stages of the writing process, including pre-writing, writing and re-writing
3	Identify effective writing techniques in his or her own work and in peer writing.
4	Improve academic and idiomatic vocabulary;
5	Understand the importance of academic writing and avoid the plagiarism
COURSE OUTCOMES	
CO1	Engage with readings critically by evaluating the various contexts (social, historical, or personal) surrounding and underpinning each text
CO2	Effectively summarize and analyze various texts while identifying and highlighting their main ideas and messages
CO3	Develop independent perspectives and arguments via persuasive support and successful incorporation of research thus developing their own voice and creating a balance between their own voice and source summaries
CO4	Practice the revision skills necessary for the accomplishment of a writing project
CO5	Constructively critique their own and peers' writing, with an awareness of the collaborative and social aspects of the writing process

UNIT 1
Academic Writing
Definition- Difference between Academic and Non-academic writing – Four types of academic writing – The 4Cs of Academic Writing- Essentials of a well-structured academic writing- (Introduction, Explanation, Illustration and Conclusion)
UNIT 2
Paragraph structure
Topic sentence - supporting examples - transition sentence- Basic rhetorical modes Narration- description – exposition
UNIT 3
Writing Process and strategy
Writing Process and strategy research, planning, summarizing, organizing, plagiarism, referencing, proofreading
UNIT 4
Structure of research paper
Structure of research paper (organizing the document, transition, data implementation and display)

UNIT 5

Writing Vocabulary and language

Writing Vocabulary and language (precision, clarity, conciseness, academic vocabulary, word choice)

Text Books:

1. Hairston, et al. The Scott, Foresman Handbook for Writers (San Francisco: Longman 2002 or latest edition)
2. Stephen Bailey Academic Writing: A Handbook for International Students

Reference Books:

3. A Short Guide to College Writing, 5th edition, by Barnet, Bellanca, and Stubbs.
4. Power of Habit by Charles Duhigg. Random House Trade Paperbacks. ISBN: 978-0-8129-8160-5. Available at the IVC bookstore. You MAY use hard copy or digital version.
5. Writing Clearly: Grammar for Editing 3rd Ed. by Janet Lane & Ellen Lange. Heinle Cengage Learning, 2012 ISBN 978-1-111-35197-7. Available at the IVC bookstore.

<table>
<tr><td>Course Title</td><td colspan="5">Basics of Financial Management for Engineers</td><td colspan="3">B. Tech.
Open Elective - II</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE611</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 90 Min</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objective:
• Provide an in-depth view of the process in financial management.
• Develop knowledge on the allocation, management and funding of financial resources.
• Improving students' understanding of the time value of money concept and the role of a financial manager in the current competitive business scenario.
• Enhancing student's ability in dealing short-term dealing with day-to-day working capital decision; and also longer-term dealing, which involves major capital investment decisions and raising long-term finance.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Knowledge of the basics of Financial Management Concepts.</td></tr>
<tr><td>CO 2</td><td colspan="8">To learn the concept of cost of capital and making decisions regarding raising of capital</td></tr>
<tr><td>CO 3</td><td colspan="8">To understand the concept of Capital structure evaluation and related decisions.</td></tr>
<tr><td>CO 4</td><td colspan="8">To build knowledge about financing and estimation of Working capital management.</td></tr>
<tr><td>CO 5</td><td colspan="8">To understand the concepts of TVM, capital budgeting decisions and evaluation of Projects.</td></tr>
<tr><td>CO 6</td><td colspan="8">Understanding of mergers, acquisitions and various other types financial restructurings</td></tr>
</table>

Unit I

Introduction to Financial Management - Concept of Business Finance, Functions of Finance, scope of Finance, Role of a Finance Manager, Goals , objectives of Financial Management, Functional areas.

Unit II

Cost of Capital - Long Term sources of finance, Concept, meaning & importance, Opportunity Cost of capital, Cost of different sources of finance, Weighted average cost of capital, factors affecting cost of capital.

Unit III

Budgeting: budgets, purpose, budgetary control, preparation of budgets, master budget, fixed and flexible
Budgeting.

Unit IV

Working Capital Management - Concept of working capital, significance, types of working capital, Factors affecting working capital needs, financing approaches for working capital, working capital estimation and calculation.

Unit V

Capital Budgeting Decision - Time Value of Money, Capital budgeting - Introduction, techniques of capital budgeting -Pay Back Method, Accounting Rate of Return, Net Present Value, Profitability Index, and Internal Rate of Return.

Text Book:

1. Financial Management by Dr. R. P. Rustagi, Taxmann's Publication.
2. Financial Management: Principles and Applications by Pearson Education; Thirteenth edition, Sheridan Titman,
3. Financial Management by I M Pandey, Pearson Education; Twelfth edition.
4. Fundamentals of Financial Management by Eugene F. Brigham, Joel F. Houston, Brigham Houston, seventh edition.
5. Financial Management Theory and Practice by Michael C. Ehrhardt and Eugene F. Brigham, Publisher, Joe Sabatino.

Reference Books:

1. Financial Management: Theory & Practice by Eugene F. Brigham and Michael C. Ehrhardt; Cengage Learning; 15 edition.
2. Fundamentals of Financial management by Dr. Eugene Brigham and Dr. Joel F.Houston: Cengage learning, Philippine Edition.
3. Financial Management Principles and practice by G. Sudarsana Reddy, Himalaya Publishing House.
4. Financial Management by Khan & Jain, Tata Mcgraw Hill.
5. Financial Management by Dr. P C Tulsian, S Chand.
6. Financial Management by Ravi Kishore, Taxmann.

Course Title	Repair & Rehabilitation of Structures					B.Tech CE VII Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE107	**Open Elective (OEC III)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 1.5 Hrs						**End Exam Duration: 3 Hrs**		

Course Objectives:
To impart knowledge on the distress in structures.
To Understand the basic concepts of deterioration of structures.
To Understand the serviceability and durability aspect of structures.
Learning the materials used for retrofitting technique.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the cause of deterioration of concrete structures.
CO 2	Able to assess the damage for different type of structures.
CO 3	Summarize the principles of repair and rehabilitation of structures.
CO 4	Recognize ideal material for different repair and retrofitting technique.
CO 5	Know the artificial polymers and rust eliminators used for retrofitting works.

UNIT – I
Introduction
Definition for Repair, Retrofitting, Strengthening and rehabilitation.Physical and Chemical Causes of deterioration of concrete structures.

UNIT – II
Damage Assessment
Purpose of assessment, Rapid assessment, Investigation of damage, Chemical and Physical damages, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non- destructive, and semi destructive testing systems.

UNIT – III
Influence of Various Elements on Serviceability and Durability
Effects due to climate, temperature, moisture, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking.

UNIT – IV
Materials for Repair and Retrofitting
Artificial fiber reinforced polymer like CFRP, GFRP,AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes andmortars, concrete chemicals, special elements for accelerated strength gain.

UNIT – V

Maintenance and Retrofitting Techniques

Importance of Maintenance. Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, externally bonding (ERB) technique.

Text Books:

1. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenanceand Repair"- Longman Scientific and Technical.
3. Repair and protection of concrete structures by Noel P.Mailvaganam, CRC Press,1991
4. Concrete repair and maintenance Illustrated by Peter.H.Emmons, Galgotia publicationsPvt. Ltd., 2001.

Reference Books:

1. R. T. Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&DCenter (SDCPL).
2. M. S. Shetty, Concrete Technology – Theory and Practice, S. Chand & Co. Ltd., NewDelhi.
3. Failures and repair of concrete structures by S.Champion, John Wiley and Sons, 1961
4. Handbook on seismic retrofit of buildings, A. Chakrabarti et.al., Narosa Publishing House,2010.

<table>
<tr><td>Course Title</td><td colspan="5">Geo-Environmental Engineering</td><td colspan="3">B.Tech CE VII Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE108</td><td rowspan="2">Open Elective
(OEC III)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
To make the students to learn the concepts of geo-environmental engineering, planning and design of waste in landfills, ash ponds and tailing ponds.
To make the students to understand the effects of pollutants on soil properties
To give awareness about the adverse effects of soil and ground water contaminants
To analyze and apply various techniques for remediation of the contaminants
To make the student to understand the reuse of waste materials in geotechnical constructions.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the different types of contaminants and their effects on subsurface soils</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand the waste contaminants and design the landfill</td></tr>
<tr><td>CO 3</td><td colspan="8">Understand the environmental impacts due to the contaminants of slurry waste</td></tr>
<tr><td>CO 4</td><td colspan="8">Adopt the type of barriers to protect the earth from different contaminants</td></tr>
<tr><td>CO 5</td><td colspan="8">Understand the engineering properties of the waste material and reuse in the construction</td></tr>
</table>

UNIT – I

Introduction

Industrialization and Urbanization, Pollution, Control, and remediation.

Contamination

Surface contamination, Contamination transport, Soil-a Geotechnical trap, Effect of subsurface contamination, Detection of polluted zone

UNIT – II

Contaminants of Solid Waste in Landfills

Waste contaminants, landfills, types, shape, and size of landfills. Liner and liner system, Cover and cover system, Stability of landfills.

UNIT – III

Contaminants of Slurry Wastes

Slurry transported wastes, slurry ponds, operation, Embankment construction and raising, Environmental Impact, and control.

UNIT – IV

Vertical Barriers for Contaminant

Contaminated sites, Types of barriers, Soil-Bentonite slurry trench walls, Cement-Bentonite slurry trench walls and construction material

UNIT – V

Geotechnical Reuse of Waste Materials

Waste reduction, use in geotechnical construction, waste characteristics, transportation consideration, Waste material in Embankment and Fills.

Text Books:

1. Lakshmi N. Reddi and Hilary I. Inyang, “Geoenvironmental Engineering: Principles and Applications”, CRC Press, United States.
2. Hari D. Sharma and Krishna R. Reddy, “Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies”, John Wiley and Sons, Inc., United States.
3. G.S. Birdie and J. S. Birdie, Water Supply and Sanitary Engineering, 8th Edition, Dhanpat Rai and Sons Publishers, New Delhi, 2010
4. H.S. Peavy and D.R.Rowe, Environmental Engineering, 1st Edition, McGrawHill Publishing Company, New York, 1984.

Reference Books:

1. David E. Daniel, “Geotechnical Practice for Waste Disposal”, Chapman & Hall, Springer Publishers, Germany.
2. Rowe R. Kerry, “Geotechnical and Geoenvironmental Engineering Handbook”, Springer Publishers, Germany.
3. Proceedings of the International symposium of Environmental Geotechnology (Vol. I and II), Environmental Publishing Company, 1986 and 1989.
4. ASTM Special Technical Publication 874, Hydraulic Barrier in Soil and Rock, 1985.

<table>
<tr><td>Course Title</td><td colspan="5">Environmental Impact Assessment</td><td colspan="3">B.Tech CE VII Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE109</td><td rowspan="2">Open Elective (OEC III)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
Deals with the various impacts of infrastructure projects on the components of environment and method of assessing the impact and mitigating the same.
The student is able to know about the various impacts of development projects on environment and the mitigating measures.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Perform a critical quality review of an EIA and EIS.</td></tr>
<tr><td>CO 2</td><td colspan="8">Structure the EIA working process considering the need for interdisciplinary.</td></tr>
<tr><td>CO 3</td><td colspan="8">Perform the screening and scoping of an EIA, based on existing Requirements, evaluate the impacts and draw meaningful conclusions from the results of the EIA.</td></tr>
<tr><td>CO 4</td><td colspan="8">Clarify the concept of EIA and its application in an international context to those involved in or affected by the EIA process.</td></tr>
<tr><td>CO 5</td><td colspan="8">Interpretation an EIA, present its conclusions and translate its conclusions into actions.</td></tr>
</table>

UNIT – I

Basic Concepts of EIA

Introduction -Initial Environmental Examination – Elements of EIA – Factors Affecting E-I-A – Impact Evaluation and Analysis – Preparation of Environmental Base Map – Classification of Environmental Parameters.

UNIT – II

EIA Methodologies

Introduction – Criteria for the Selection of EIA Methodology – E I A Methods – Ad-Hoc Methods – Matrix Methods – Network Method – Environmental Media Quality Index Method – Overlay Methods and Cost/Benefit Analysis.

UNIT – III

Environmental Management Plan

EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.

UNIT – IV

Assessment of Impact on Vegetation and Wildlife

Introduction – Assessment of Impact of Development Activities on Vegetation and Wildlife.

Environmental Audit

Introduction - Environmental Audit & Environmental Legislation – Objectives of Environmental Audit – Types of Environmental Audit – Audit Protocol – Stages of Environmental Audit – Evaluation of Audit Data and Preparation of Audit Report.

UNIT – V

Environmental Acts (Protection and Prevention)
Post Audit Activities-The Air, water, Wild Life and Environmental Protection (Prevention Control Acts).
Case Studies
Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Highway project, Sewage treatment plant,

<u>**Text Books:**</u>

1. Y Anjaneyulu and Valli Manickam "Environmental Impact Assessment Methodologies", B S Publications, Sultan Bazar, Hyderabad.
2. J Glynn Henry and Gary W Heinke "Environmental Science and Engineering", Prentice-Hall of India (P) Limited, New Delhi.

<u>**Reference Books:**</u>

1. Dr. Suresh K Dhameja "Environmental Science and Engineering", S K Kataria & Sons Publishers, New Delhi.
2. H S Bhatia "Textbook on Environmental Pollution and Control", Galgotia Publications Pvt. Limited, New Delhi.
3. Rau and Wooten "Environmental Impact Analysis Handbook", Tata McGraw-Hill Companies, Inc. New York.

<table>
<tr><td>Course Title</td><td colspan="4">Intelligent Control Techniques</td><td colspan="4">B. Tech. EEE
Open Elective - III</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE205</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 1Hr30M</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to learn neural network and fuzzy logic concepts and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand architecture and approach to Artificial intelligence</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms and their models</td></tr>
<tr><td>CO 3</td><td colspan="8">Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic systems</td></tr>
<tr><td>CO 4</td><td colspan="8">Understand the Bio-inspired and Swarm Intelligence Algorithms</td></tr>
</table>

UNIT - I

Introduction to Artificial Intelligence: Introduction and motivation – Approaches to AI – Architectures of AI – Symbolic Reasoning System –Rule based Systems – Knowledge Representation.

UNIT - II

Artificial Neural Networks: Basics of ANN - Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules.

UNIT - III

ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks – Associative Memories Neural Networks as Associative Memories

UNIT - IV

Fuzzy Logic: Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System – Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

UNIT - V

Evolutionary Computation - Overview of other Bio-inspired Algorithms - Swarm Intelligence Algorithms

Text Books

1. Introduction to Neural Networks using MATLAB by S. N. Sivanandam, S. Sumathi and S. N. Deepa, Tata McGraw Hill Edition, 2006.
2. Kumar S., "Neural Networks - A Classroom Approach", Tata McGraw Hill, 2004.
3. Fuzzy Logic with Engineering Applications by Timothy J. Ross, WILEY India Edition, 3rd Edition, 2012.

Reference Books

1. Intelligent System – Modeling, Optimization & Control by Yung C. Shin and Chengying Xu, CRC Press, 2009.
2. Eiben A. E. and Smith J. E., "Introduction to Evolutionary Computing", Second Edition, Springer, Natural Computing Series, 2007.
3. Engelbrecht A. P., "Fundamentals of Computational Swarm Intelligence", John Wiley & Sons, 2006.

<table>
<tr><td>Course Title</td><td colspan="4">Electrical System Estimation & Costing</td><td colspan="3">B. Tech. EEE
Open Elective - III</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE206</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1Hr30M</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to learn about estimating and costing of wiring systems, earthing systems, various light schemes and its calculations.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand principles of wiring systems and its estimation based on choice of wiring system</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand the concepts of earthing systems</td></tr>
<tr><td>CO 3</td><td colspan="8">Understand various lightening schemes and its calculations used for domestic and industrial applications</td></tr>
<tr><td>CO 4</td><td colspan="8">Analyze estimation of wiring to residential & commercial buildings</td></tr>
</table>

UNIT-I

General principles of estimating: Estimating – purpose of estimating and costing – catalogues – market survey and source selection - determination of required quantity of materials – determination of cost material and labor.

Wiring systems: Introduction – Systems of distribution of electrical energy – methods of wiring – systems of wiring – choice of wiring systems.

UNIT – II

Earthing Systems: Earthing – Points to be earthed – Factors influencing earth resistance – methods od reducing Earth resistance – Design data on earth electrodes – Methods of earthing – determination of size of earth wire and earth plate – Effects of electric current on Human body – Measurement of earth resistance.

UNIT - III

Lighting schemes and calculations: Types of lighting circuits – Various circuit diagrams – Two way switching – Aspects of good lighting service – Types of lighting schemes – Filament Lamps- Gas filled Lamps – Fluorescent Tubes - LED lamp – Compact Fluorescent lamp (CFL) – comparison between LED and CFL – terms used in illumination – laws of illumination.

UNIT - IV

Estimation of lighting schemes: Design of lighting schemes - Factory lighting – Public lighting installations: Classification – General principles – Design – Selection of equipment - Street lighting – Methods of lighting calculations.

UNIT-V

Internal wiring estimation: General rules for wiring – determination of number of points – determination of total load – determination of sub circuits – determination of ratings of main switch and distribution board – determination of size of conductor – layout – simple problems.

Text books

1. Electrical installation estimating & Costing – J.B.Gupta, S.K.Kataria& sons.
2. Electrical design estimating and costing – K.B.Raina&S.K.Bhattacharya, NewAge International (P) Limited publishers.

Reference Books

1. Power System Analysis and Design – Dr.B.R.Gupta, S.Chand Publications
2. Electrical Estimating methods – Wayne J.Del Pico, Wiley Publishers

<table>
<tr><td>Course Title</td><td colspan="4">Entrepreneurship</td><td colspan="3">B.Tech ME VII Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE311</td><td rowspan="2">OEC- III</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- Understand the concepts of entrepreneurship, its need and scope Understand meaning of term entrepreneur, classification of entrepreneur and qualities of an entrepreneur.
- Concept and procedure of idea generation
- Elements of business plan and its procedure
- Project management and its techniques
- 5Behavioral issues and Time management

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify opportunities and deciding nature of industry.
CO 2	Know the importance of Women entrepreneurship, Brainstorm ideas for new and innovative products or services.
CO 3	Identify the importance of MSME and know the preparation of Business plan.
CO 4	Use project management techniques like PERT and CPM.
CO 5	Analyze behavioral aspects and use time management matrix.

UNIT-I

Entrepreneur and Entrepreneurship: Concept of Entrepreneur, Characteristics of entrepreneur, Functions of an Entrepreneur, Types of entrepreneur, Concept of Entrepreneurship, Types of Entrepreneurship, Enterprise, Types of Enterprise, Entrepreneurial Myths, Challenges and Opportunities in Entrepreneurship in India, Role of Entrepreneurship in Economic Development,

UNIT-II

Women Entrepreneurship and Choice of Technology: Concept of Women Entrepreneur ,Problems of Women Entrepreneur ,Growth of women entrepreneurship in India, Evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development, Social Responsibility and Business Ethics.

UNIT-III

MSMEs& New Venture Creation: Concept of MSME, Role & Importance of MSMEs, Growth & development of MSMEs in India, Current schemes for MSMEs, Business opportunities in India, Elements of Business Plan and its salient features presenting a business plan.

UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden.

UNIT-V

Entrepreneurial Behaviours and Motivation: Introduction, Entrepreneurial Input, And Entrepreneurial Motivation: Concept and Need, Theories of Motivation, Motives for Entrepreneur

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Elias G. Carayannis,Elpida T. Samara "Innovation and Entrepreneurship", Springer
2.Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi
4. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd.

Reference Books:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Me Graw Hill Publishing Company Ltd., 2015.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication.
3. Sudha G.S., "Organizational Behavior", National Publishing House, 1996.

Course Title	Solar Energy Systems					B.Tech ME VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE312	**OEC- III**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 90 Minutes					**End Exam Duration: 3Hrs**			

Course Objectives:

- Familiarize with basics of solar radiation, available solar energy and its measurement.
- Familiarize with solar collectors, construction and operation of solar collectors.
- Understand solar energy conversion systems, applications and power generation.
- Learn the principles PV technology and techniques of various solar cells/ materials for energy conversion
- Know the advance current technology of the solar energy systems for making the process economical, environmentally safe and sustainable.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Gain Knowledge On Basic Concepts Of Solar Radiation And Solar Collectors.
CO 2	Illustrate Design And Operation Of Solar Heating And Cooling Systems.
CO 3	Discuss The Principles Of Solar Thermo Photovoltaic cells
CO 4	Analyze The Performance Of A Solar Cell Array System.
CO 5	Explain Passive Heating Concepts And Passive Cooling Concepts.

UNIT – I

Solar radiation and collectors

Solar angles – Sun path diagrams – Radiation - extra terrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods-evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.

UNIT-II

Solar thermal technologies

Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying.

UNIT – III

Solar PV fundamentals

Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaic cells.

UNIT - IV

SPV system design and applications

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

UNIT - V

Solar passive architecture

Thermal comfort - bioclimatic classification – passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - Radiative cooling - application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. – Energy efficient landscape design - thermal comfort.

Text Books:

1Goswami D.Y., Kreider, J. F. and Francis., “Principles of Solar Engineering’, Taylor and Francis, 2000.

2.Chetan Singh Solanki, “Solar Photovoltatics – Fundamentals, Technologies and Applications”, PHI Learning Private limited,
2011.

Reference Books:

1. Sukhatme S.P.,. Nayak.J.P, ‘Solar Energy – Principle of Thermal Storage and collection”, Tata McGraw Hill, 2008.
2. Solar Energy International, “Photovoltaic – Design and Installation Manual” – New Society Publishers, 2006.
3. Roger Messenger and Jerry Vnetre, “Photovoltaic Systems Engineering”, CRC Press, 2010.

<table>
<tr><td>Course Title</td><td colspan="4">Internal Combustion Engine</td><td colspan="3">B.Tech ME VII Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE313</td><td rowspan="2">OEC- III</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
This course provides techniques of applying management principles to professional positions held by Engineers and Engineering Technologists
The management functions, especially suited to scientist & Professionals in technical and industrial environment are part of the curriculum
Students are exposed to the theory and practices of modern management approaches, tools and techniques in complex industrial & Competitive economic environment</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Use knowledge and comprehension in management tools to apply in technical organizations.</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand and build their analytical abilities in the use of Industrial Management</td></tr>
<tr><td>CO 3</td><td colspan="8">Use management techniques to direct the organizations/industries for goal achievement</td></tr>
<tr><td>CO 4</td><td colspan="8">Solve problems associated with the operations management and scheduling of resources in efficiently and effectively.</td></tr>
<tr><td>CO 5</td><td colspan="8">The students may be asked use knowledge of management techniques and write a computer program to address and solve more complicated problems and to study the effect of various parameters on the management/organization</td></tr>
</table>

UNIT – I

Power Cycles:

Carnot cycle, Air standard cycles -Description and representation of Otto cycle, Diesel cycle &
Dual cycles on P–V and T-S diagram -Thermal Efficiency – Comparison of Otto, Diesel and Dual cycles. Simple problems on Otto, Diesel and Dual cycles

UNIT-II

I.C. Engines:

Energy conversion – basic engine components –Classification of I.C. Engines, Working principle of two stroke and four stroke engines - comparison of two stoke and four stroke, SI and CI engines –Valve and port timing diagrams, application of I.C Engines.

UNIT – III

Engine Systems:

Working principle of, Magneto & Battery Ignition System **-** Simple Carburetor - Common rail
fuel Injection System - Air & Thermostat cooling system - Petrol & Pressure Lubrication system.

UNIT - IV

Combustion in S.I. Engines:

Homogeneous Mixture - Stages of combustion - Importance of flame speed and factors influencing the flame speed –Abnormal Combustion - Phenomenon of Knocking, Summary of Enginevariables affecting the knocking, pre-ignition.

UNIT - V

Testing and Performance:

Engine Performance Parameters - Determination of brake power, friction power and indicated power – Performance test – Heat balance sheet and chart- Emissions from Diesel & Petrol Engines, Euro Norms - Simple problems on performance and heat balance sheet.

Text Books:

1. I.C. Engines, V. GANESAN- TMH.
2. I.C. Engines / Heywood /McGraw Hill.

Reference Books:

1. Thermal Engineering / R.K Rajput / Lakshmi Publications.
2. I.C Engines – Mathur& Sharma – DhanpathRai& Sons.
3. Engineering fundamentals of I.C Engines – Pulkrabek / Pearson /PHI
4. Thermal Engineering / Rudramoorthy – TMH

<table>
<tr><td>Course Title</td><td colspan="4">Operating Systems
(Open Elective Course -III)</td><td colspan="3">B.Tech VII Sem (R20) CSE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE505</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid ExamDuration:90 Minutes</td><td colspan="4">EndExamDuration:3Hrs</td></tr>
</table>

Course Objectives:

- Have an overview of functions of operating systems.
- Have a thorough knowledge of process management and memory management.
- To have a thorough knowledge of how handle to deadlocks.
- Learn the concepts of files, protection and security.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand the basic concepts related to the operating systems.
CO 2	Analyze the various process scheduling algorithms and process synchronization mechanisms.
CO 3	Analyze the various memory management schemes.
CO 4	Understand the ways to deal the deadlocks and the basic concepts related to files in the system.
CO 5	Analyze the protection and security mechanisms

UNIT - I

Operating Systems Basics: Operating systems functions, Overview of computer operating systems, distributed systems, operating system services and systems calls, system programs, operating system structure.

UNIT - II

Process Management: Process concepts, scheduling-criteria, algorithms, their evaluation.

Concurrency: Process synchronization, the critical-section problem, Peterson‘s Solution, semaphores, monitors.

UNIT-III

Memory Management: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, Allocation of frames.

UNIT-IV

Deadlocks: system model, deadlock characterization, deadlock prevention, detection and avoidance, recovery form deadlock.

Files: The concept of a file, Access Methods, Directory structure, File system mounting.

UNIT-V

Protection: Protection, Goals of Protection, Domain of protection ,
Access Matrix, Implementation of Access Matrix.

Security: Security problems, User authentication.

Text Books:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Eighth edition, John Wiley.
2. Andrew S Tanenbaum, "Modern Operating Systems", Fourth Edition, Pearson Education
3. William Stallings, "Operating Systems: Internals and Design Principles", Sixth Edition2009, Pearson Education.
4. D.M.Dhamdhere, "Operating Systems, A Concept based Approach", Third Edition, TMH

Reference Books:

1. A.S.Godbole, "Operating Systems", Second Edition, TMH.
2. Operating Systems: A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition.
3. Operating Systems – H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson.
4. Operating Systems: A Practical Approach, Rajiv Chopra, 4^{th} Edition, S Chand Publishers.

<table>
<tr><td>Course Title</td><td colspan="5">R Programming
(Open Elective Course - III)</td><td colspan="3">B.Tech VII Sem (R20) CSE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE506</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- Optimize business decisions and create competitive advantage with Big data analytics.
- Practice java concepts required for developing map reduce programs.
- Impart the architectural concepts of Hadoop and introducing map reduce paradigm.
- Practice programming tools PIG and HIVE in Hadoop ecosystem.
- Implement best practices for Hadoop development.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the installation of VMW is and PIG.
CO 2	Understand and apply the setting up and Installing Hadoop in its three operating modes.
CO 3	Implement the file management tasks in Hadoop.
CO 4	Understand Map Reduce Paradigm.
CO 5	Understand Pig Latin scripts sort, group, join, project, and filter your data.

UNIT-I

Introduction to R: What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Few commands to get started: installed.packages(), packageDescription(), help(), find.package(), library() - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits – Special Values functions : NA, Inf and–inf.

UNIT-II

R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame – **R - Variables:** Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables - **R Operators**: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - **R Decision Making:** if statement, if – else statement, if– else if statement, switch statement – **R Loops:** repeat loop, while loop, for loop - Loop control statement: break statement, next statement.

UNIT-III

R-Function : function definition, Built in functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values - **R-Strings** – Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower() - **R Vectors –** Sequence vector, rep function, vector access, vector names, vector math, vector recycling**,** vector element sorting **- R List -** Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector - **R Matrices –** Accessing Elements of a Matrix, Matrix Computations: Addition, subtraction, Multiplication and Division- **R Arrays:** Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements, Calculation Across Array Elements - **R Factors** –creating factors, generating factor levels gl().

UNIT-IV

Data Frames –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, **Expand Data Frame**: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge() – Melting and Casting data melt(), cast().

Loading and handling Data in R: Getting and Setting the Working Directory – getwd(), setwd(), dir() - **R-CSV Files -** Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File – **R -Excel File** – Reading the Excel file.

UNIT-V

Descriptive Statistics: Data Range, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median - Mode **- Standard Deviation – Correlation - Spotting Problems in Data with Visualization:** visually Checking Distributions for a single Variable **- R –Pie Charts**: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – **R Histograms** – Density Plot **- R – Bar Charts**: Bar Chart Labels, Title and Colors.

Text Books:

1. ROBERT I. KABACOFF "R in Action Data analysis and graphics with R" Manning Publications Co 2011.
2. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018, ISBN: 978-93-5260-524-8.
3. Tutorials Point (I) simply easy learning, Online Tutorial Library (2018), *R Programming*,

Retrieved from https://www.tutorialspoint.com/r/r_tutorial.pdf.

4. Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015, ISBN: 978-1-119-05580-8.

<table>
<tr><td>Course Title</td><td colspan="4">CYBER SECURITY
(Open Elective Course – III)</td><td colspan="4">B.Tech. VII Sem (R20UG) AI&ML</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE3905</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>EndExam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To learn about cybercrimes and how they are planned
- To learn the vulnerabilities of mobile and wireless devices
- The learner will gain knowledge about securing both clean and corrupted systems, protect personal data, and secure computer networks

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understanding the basic cyber security concepts
CO 2	Classifying the international laws and cyber forensics
CO 3	Remembering to cyber-crime.
CO 4	Recognizing cybercrime and cyber terrorism.
CO 5	Understanding the privacy issues.

UNIT - I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT - II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless ComputingEra, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT- IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT - V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains medical, financial, etc.

Text Books:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley

2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

3. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

4. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin, CRC Press T&F Group.

Reference Books:

1. Cyber Security Engineering: A Practical Approach for Systems and Software Assurance, Nancy R. Meade, Carol C. Woody, Addison Wesley.

2. The Cyber Security: Self help Guide, Arun Soni, CRC Press.

3. Cyber Security: Analytics, Technology & Automation, Martti Lehto, Pekka Neittaanmaki, Springer.

4. Cyber Security: Essentials, Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, SYBEX.

<table>
<tr><td>Course Title</td><td colspan="4">JAVA PROGRAMMING
(Open Elective Course – III)</td><td colspan="4">B.Tech. VII Sem (R20UG) AI&ML</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE3906</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>ContinuousInternal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- To give the students a firm foundation on Java concepts like Primitive data types, Java control flow, Methods, Object-oriented programming, Core Java classes, packages and interfaces, multithreading.
- To provide the students with an understanding of Java applets, Abstract Window, Toolkit and exception handling.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Solve problems using object oriented approach and implement them using Java
CO 2	Apply the concept of inheritance, polymorphism and Packages, Interfaces
CO 3	Implement Exception handling and able to develop multithreaded applications with synchronization.
CO 4	Able to develop applets for web applications.
CO 5	Able to design GUI based applications.

UNIT – I

Object Oriented Programming basics: Need for OOP paradigm, Principles of OOPconcepts.

Java Basics: History of Java, Java buzzwords, Simple java program, classes and objects – concepts of classes, objects, constructors, methods, Introducing access control**, this** keyword, overloading methods and constructors.

UNIT – II

Inheritance: Inheritance basics, Types of Inheritance, benefits of inheritance, **super** uses, using **final** with inheritance, polymorphism- method overriding, abstract classes.

Packagesand Interfaces: Defining, Creating and Accessing a Package, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT – III

Exception handling and multithreading: Concepts of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads.

UNIT – IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling Mouse and Keyboard events, Adapter classes, The AWT class hierarchy, user interface components- Labels, Button, Scrollbars, Text Components, Check box, Choices,

UNIT – V

Applets: Concepts of Applets, differences between applets and applications, life cycle of an Applet, creating applets, passing parameters to applets.

Text Books:

1. Java; the complete reference, 7th editon, Herbert schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.
3. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell,eighth Edition, Pearson Education.
4. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell,eighth Edition, Pearson Education.

Reference Books:

1. An Introduction to programming and OO design using Java, J.Nino andF.A.Hosch, John wiley & sons.
2. An introduction to Java programming and object oriented applicationdevelopment, R.A. Johnson- Thomson.
3. Object Oriented Programming through Java, P. Radha Krishna, University Press.

<table>
<tr><td>Course Title</td><td colspan="4">Transforms and Their Applications</td><td colspan="3">OPEN ELECTIVE-III</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE612</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td></td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
To enable the students to apply the knowledge of mathematics in various engineering fields by making them to learn the following:
• Laplace Transforms is used for making predictions and making analysis in data mining.
• Laplace transforms in engineering problems.
• Understand Fourier Transforms and apply them in solving problems.
• Inculcate the concept of Z-Transforms and its applications.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand Laplace Transforms in engineering problems.</td></tr>
<tr><td>CO 2</td><td colspan="8">Apply Laplace Transforms in engineering problems.</td></tr>
<tr><td>CO 3</td><td colspan="8">Understand Fourier Transforms in engineering problems.</td></tr>
<tr><td>CO 4</td><td colspan="8">Apply Fourier Transforms in engineering problems.</td></tr>
<tr><td>CO 5</td><td colspan="8">Understand concept of Z-Transforms and its applications.</td></tr>
</table>

UNIT I:

Laplace transforms of standard functions – Properties of Laplace Transforms - Transforms of derivatives and integrals- Evaluation of integrals by Laplace transforms – Unit step function – Second shifting theorem – Dirac's delta function. Laplace transforms of periodic functions.

Learning Outcomes:
At the end of this unit, the student will be able to

- Understand Laplace Transforms in engineering problems.

UNIT II:

Inverse Laplace Transforms. Convolution theorem – Applications of Laplace transforms to ordinary differential equations.

Learning Outcomes:
At the end of this unit, the student will be able to

- Apply Laplace Transforms in engineering problems.

UNIT III:

Fourier integral theorem (only statement) – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – Properties of Fourier transform.

Learning Outcomes:
At the end of this unit, the student will be able to

- Understand Fourier Transforms in engineering problems.

UNIT: IV:

Inverse transforms – Convolution theorem of Fourier transform- Parseval's identity for Fourier transforms- Relation between Fourier and Laplace transforms. Fourier transforms of the derivatives of a Function. Applications of transforms of boundary value problems (Only Heat Conduction).

Learning Outcomes:
At the end of this unit, the student will be able to

- Apply Fourier Transforms in engineering problems.

UNIT V

z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

Learning Outcomes:
At the end of this unit, the student will be able to

- Understand concept of Z-Transforms and its applications.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-43 edition 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9^{th} edition-2013.
3. Engineering Mathematics Volume-1, Dr. D.S Chandra Sekharaiah, Prism Books Pvt. Ltd.
4. Engineering Mathematics by Srimanta Pal, Subodh C. Bhunia, Oxford University Press.

Reference Books:

1. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt. Ltd, New Delhi, 11^{th} Edition, Reprint 2010.
2. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, Lakshmi Publications, Reprint 2008.
3. Advanced Engineering Mathematics, Greenberg Michael D, Cengage Publishers.
4. Introduction to Laplace Transforms and Fourier Series, Philip Dyke, Springer.

<table>
<tr><td rowspan="1">Course Title</td><td colspan="4">PHYSICS OF RENEWABLE ENERGY</td><td colspan="3">OPEN ELECTIVE – 3</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE613</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End lab Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

COURSE OBJECTIVES:
1. A top priority for developing renewable energy in India is to boost the economy, encourage the development of energy security, and reduce carbon emissions.
2. Promote sustainable development and promote economic integration.
3. Ensure that any energy sector products that come into use do so with minimal impact on the environment.
4. Take every step to ensure that energy generation, conversion, and use are cost-competitive.

COURSE OUTCOMES: Upon completion of the course, the student will be able to:

CO1	**Understand** the energy resources.
CO2	**Apply** the Solar energy.
CO3	**Idealized** wind turbine
CO4	**Underground** heat – Micro hydro plants.
CO5	**Classify** the different types of energy resources.

UNIT I: Bio diversity conception individuals

Introduction to renewable energy– Biogas cogeneration – Wood as a source of energy – Energy crops – Bio diesel – Fuel from plantation – Ethanol – Synthesis fuels.

UNIT II: Solar energy

Solar thermal: Solar collectors – Hot water from Sun – Cooling with the Sun – Solar drying – Air collectors – Solar thermal power plants.

Solar electric: Photo voltaic effect – The heart of a PV array – The solar cell – Solar energy as part of sustainable development.

UNIT III: Wind Energy

Power in the wind: Aerodynamics principles of wind turbines – Power available in the wind – Rotor efficiency – Factors affecting wind power – Impact of tower height – Wind turbines sitting – Idealized wind turbine – Power curve – Speed control for maximum power.

UNIT IV: Hydro-Energy

Introduction -Water power – Ocean wave and tidal energies – Hydro power nature conservation – Underground heat – Micro hydro plants.

UNIT V: Geothermal Energy

Introduction-Geothermal Resource -Mining Thermal Energy From a Hot Dry Rock-Geothermal Heat Pumps-Active Volcanoes, Plate Tectonics, and the “Ring of Fire”.

Text books:

1. Hand book of renewable energy technology -A.F.Zobba and R.Bansal, World scientific publications.
2. Renewable energy: The facts - Dieter Scirfried and Walter Witzel. Earth scan publications for sustainable future.

Reference books:

3. http://www.law.du.edu/index.php/the-renewable-energy-reader/6-geothermal

Course Title	Fuel Technology					B. Tech. (Open elective-III)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE614	**Open Elective**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- The students will have the general knowledge of Fuels in the context of clean power, sustainability and alternative fuels
- To build up knowledge of concepts and theories of fuel combustion & control process

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	**Recall** the Characteristics & properties of a fuel.
CO 2	**Analyze** the concepts of solid fuels and evaluate the calorific value of solid fuels by Bomb Calorimeter.
CO 3	**Explore** the synthesis of synthetic petrol & process of Refining of petroleum.
CO 4	**Identify** various gaseous fuels and explain their preparation and properties.
CO 5	**Discuss** about the purpose of different alternative fuels, merits & demerits of alternative fuels

UNIT-I-Introduction

Fuels-Introduction, Classification of Fuels, Differences between Solid, Liquid & gaseous fuels. Characteristics of a Good fuel, Calorific Value of Fuels-Gross calorific value(GCV) & Net calorific Value (NCV)- definition, units & their relation, Numerical problems on calorific value.

Learning Outcomes:

At the end of the unit, The students will be able to

- Classification of fuels
- Analyze the characteristics of a good fuel

UNIT-2-Solid Fuels

Introduction, Types of Coal, Coal formation, Properties, Advantage & disadvantages of solid fuels. Proximate & Ultimate analysis of coal. Manufacture of metallurgical Coke-Otto Hoffmann method, Determination of Calorific value of solid fuel by Bomb calorimeter,

Learning Outcomes:

At the end of the unit, The students will be able to

- Explain the advantages and disadvantages of solid fuel
- Determine the calorific value of fuel by Bomb Calorimeter

UNIT-3-Liquid Fuels

Introduction, Properties, Advantages & disadvantages of Liquid fuels, Classification of petroleum, refining of petroleum-Fractional distillation of crude oil, uses of various petroleum products, Synthetic Petrol- methods-Fischer-Tropsch method and Bergius process. Knocking-Octane number, Cetane Number-Definitions

Learning Outcomes:
At the end of the unit, The students will be able to

- Explain the advantages and disadvantages of Liquid fuel.
- Discuss about refining of petroleum and uses of various petroleum products.

UNIT-4-Gaseous Fuels
Introduction, Properties, Advantages & disadvantages Of Gaseous fuels - Preparation, properties & uses of Natural gas, producer gas, water gas, Propane. Determination of calorific value of gaseous fuels by Junker's Gas Calorimeter-Principle & applications.

Learning Outcomes:
At the end of the unit, The students will be able to

- Explain the advantages and disadvantages of Gaseous fuel.
- Preparation and properties of different types of gaseous fuels

Unit-5-Need for Alternate Fuels
Need for alternate fuels- Effects of Exhaust gas emissions on environment & Humans (NO, NO_2, CO_2, CO, SO_X). Introduction to alternate fuels- General uses of alternate fuels like Hydrogen, LPG, CNG, Biogas, Methanol, Ethanol, Butanol. Biofuels-Types of Biofuels, Applications of Biofuels, Merits & demerits of alternate fuels.

Learning Outcomes:
At the end of the unit, The students will be able to

- Know about the effects of exhaust gas emissions on environment and humans.
- Analyze the merits and demerits of alternate fuels

Textbooks:

1. Text Book of Engineering Chemistry, Shashi Chawla, Dhanapath Rai Publications, New Delhi, 4th Edition, 2011.
2. Internal Combustion Engine Fundamentals, Heywood John B, Pragnya IAS Publications
3. General Chemistry for Engineers, Jeffrey S. Gaffrey & Nancy A. Marky
4. Fuels & Fuel- Additives, S.P.Srivastava , Jeno Hancsok, Willey Publications

REFERENCES:

1.A Text Book of Engineering Chemistry, Jain and Jain, Dhanapath Rai Publishing Company, New Delhi, 15th Edition, 2010.

2. Alternative Liquid fuels, Desai Ashok V, Willey Publications

3. Introduction to Combustion, Turns Stephen R, Mc GrawHill Publications

4. Fuels and Fuels Technology, Wilfrid Francis, Martin C. Peters, 2nd edition, Elsevier publications

<table>
<tr><td>Course Title</td><td colspan="4">PROFESSIONAL COMMUNICATION</td><td colspan="3">OPEN ELECTIVE – III</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE615</td><td rowspan="2">HUM</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Min</td><td colspan="4">End Exam Duration: 3Hours</td></tr>
</table>

Objectives:

- To help the students get on in their professions and get success professionally.
- To help the students learn communication techniques.
- To make the students thorough with presentation skills to become effective participants in various discussions.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	The students will be able to understand the processes of communication and apply communication techniques for effective communication.
CO 2	The students will be able to improve group behaviour and participate effectively in the team work thereby improving professional prospects.
CO 3	The students will be able to present effectively orally and in writing

Syllabus

Unit :1

1. **Professional Communication**

Role of Professional Communication- Professional Communication Skills- Tips to improve professional communication skills.

Unit 2

Technical Communication

Significance of technical communication- Use of vocabulary in formal letters / reports and e-mails.- Compound words , misspelled words, using of similar words to express the idea, analogies. Grammar: Subject - Verb agreement, Active and Passive voice, Embedded sentences, clauses and conditionals.

Unit 3

Reading Comprehension

Comprehension - Reading comprehension techniques-Styles, speed and evaluation of Reading - critical reading- Paraphrasing / summarizing: SQ3R method, PQRST method

Unit 4

Oral Presentation

Oral Presentation techniques- Public speaking - guidelines for presentation- tone and voice modulation- Use of visuals in presentation- Group Discussion - strategies

Unit 5

Writing Skills

Writing - formal and informal writing - formal and informal letters - formal and informal reports- Common errors in writing, elements of styles- Analytical and issued based essays.

Reference Books

1. Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw Hill Education, 2017.

2. Raman Sharma, “Technical Communications”, Oxford Publication, London, 2004.

3. Meenakshi Raman and Sangeetha Sharma, “Technical Communication: Principles Practice”, 2nd Edition, Oxford University Press, 2011

4. English for Engineers and Technologists (Combined edition, Vol. 1 and 2), Orient Black swan 2010.

5. Stephen E. Lucas, "The Art of Public Speaking", 10th Edition; McGraw Hill Education, 2012.

6. William Strunk Jr. & E.B. White, "The Elements of Style", 4th Edition, Pearson, 1999.

7. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.

8. Goodheart-Willcox, "Professional Communication", First Edition , 2017.

9. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6 edition,2015.

10. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1edition, 2013.

<table>
<tr><td>Course Title</td><td colspan="5">Digital & Social Media Management</td><td colspan="3">B. Tech.
Open Elective - III</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE616</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 90 Min</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
</table>

Course Objectives: The objective of the course is

- Review key trends within the Digital Marketing landscape. Examine an example of each Digital Marketing channel.
- Examine SEO's Position as a Fundamental Building Block for Online Marketing
- Identify and appropriately apply Fundamental Factors That Result in Achieving Top Search Engine Rankings.
- Develop an email and sending strategy that adheres to email compliance best practices. Analyze the role that social marketing plays in the digital landscape and marketing mix.
- Identify and incorporate individual social and mobile platforms into a digital marketing strategy. Utilize Google Analytics to examine the role that web analytics play in digital marketing

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Explain the role and importance of digital marketing, Ability to comprehend how digital media can be used for current marketing practices.
CO 2	Understanding of Search Engine optimization, Pay per click and Email marketing,
CO 3	Analyze the role that social media marketing plays in the digital landscape and marketing mix.
CO 4	Identify and incorporate individual social and mobile media platforms into a digital marketing strategy.
CO 5	Understanding of content creation, content marketing channels, writing messages and content marketing plan, Utilize Google Analytics to examine the role that web analytics play in digital marketing.

Unit I

Introduction to Digital Marketing: Introduction to marketing in the digital environment, Online marketplace analysis: micro-environment - The Internet macro-environment, What Are the 3i Principles?

Unit II

Digital Marketing Strategy: Content Marketing - Online Offer - Online Space / website Selling - Online Value - Internet for Distribution.
Search Engine Marketing: Search Engine Optimization, Pay Per Click, Digital Display Advertising, Introduction to page rankings, Email Marketing.

Unit III

Social Media Marketing: Social Media, Social Media Mining, Content guidelines for online communications, Social Media Channels and Social Media Strategy. Cyber crime and security.

Unit IV

Mobile Marketing: Mobile Marketing Fundamentals, Mobile consumers, Digital consumption, M-commerce, Technological change and marketing, Overview of mobile and app based marketing, Mobile websites, Conducting Mobile Audits, Strategic objectives.

Unit V

Facebook for Business: Facebook for Business-Facebook fan Engagement, Anatomy of Ad Campaign, Adverts Types of adverts, Adverts Targeting. Case Study-Tata DoCoMo

<u>Text Books</u>

1. Digital Marketing: by Raghavendra K & ShrutiPrabhakar, HPH

<u>References</u>

1. e Marketing: The Essential Guide to Digital Marketing: by Rob Stokes (2010), Quirk Education.
2. The Art of Digital Marketing: by Ian Dodson, Wiley.
3. Social Media Marketing: Strategies for Engaging in Facebook, Twitter & Other Social Media: by Liana Evans, Que Publishing
4. E-Marketing: by Strauss, J. and Frost, R., Pearson Education, Inc

<table>
<tr><td>Course Title</td><td colspan="5">Industrial Safety Engineering</td><td colspan="3">B.Tech CE VII Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE110</td><td rowspan="2">Open Elective (OEC-IV)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
The course is intended to give knowledge of various safety management principles, various safety systems, various machine guarding devices, hazard identification techniques, energy sources, systems & applications and the need in the present context. Learners will be able to compare different hazard identification tools and choose the most appropriate based on the nature of industry</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Describe the theories of accident causation and preventive measures of industrial accidents</td></tr>
<tr><td>CO 2</td><td colspan="8">Explain about personal protective equipment, its selection, safety performance & indicators and importance of housekeeping</td></tr>
<tr><td>CO 3</td><td colspan="8">Explain different safety issues in construction industries.</td></tr>
<tr><td>CO 4</td><td colspan="8">Describe various hazards associated with different machines and mechanical material handling.</td></tr>
<tr><td>CO 5</td><td colspan="8">Utilise different hazard identification tools in different industries with the knowledge of different types of chemical hazards.</td></tr>
</table>

UNIT – I

Safety Introduction

Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.

UNIT – II

Personal Protection in Work Environment

Personal protection in the work environment, Types of PPEs, Personal protective equipment respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

UNIT – III

Safety Issues in Construction

Introduction to construction industry and safety issues in construction Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning & Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Confined space – Temporary Structures. Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety. Relevance of ergonomics in construction safety. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.

UNIT – IV

Safety Hazards in Machines

Machinery safeguard-Point-of-Operation, Principle of machine guarding -types of guards and devices. Safety in turning, and grinding. Welding and Cutting-Safety Precautions of Gas welding and Arc Welding. Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment-operation & maintenance. Maintenance of common elements-wire rope, chains slings, hooks, clamps. Hearing Conservation Program in Production industries.

UNIT – V

Hazard and Risk

Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment.

Text Books:

1. R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
2. Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.
3. Krishnan, N.V. (1997). Safety management in Industry. Jaico Publishing House, New Delhi.
4. John V. Grimaldi and Rollin H.Simonds. (1989) Safety management. All IndiaTraveller Book Seller, Delhi.

Reference Books:

1. Ronald P. Blake. (1973). Industrial safety. Prentice Hall, NewDelhi.
2. Alan Waring. (1996). Safety management system. Chapman & Hall, England.
3. Vaid, K.N., (1988). Construction safety management. National Institute of Construction Management and Research, Mumbai.
4. AIChE/CCPS. (1992). Guidelines for Hazard Evaluation Procedures. (second edition). Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York.

<table>
<tr><th>Course Title</th><th colspan="5">Surveying</th><th colspan="3">B.Tech CE VII Sem (R20)</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">20OE111</td><td rowspan="2">Open Elective (OEC IV)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td></td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

Be familiar with Chain and Compass in measuring the horizontal and verticaldistances, calculating simple areas, and correcting different errors.
Identify the level instruments; record the levels in field book and determine thereduced levels of objects by different methods.
Determine the areas and volumes on the field by different rules and methods.
Using totalstation instrument for measuring the distances, angles, and areas.
Understand the concepts of photogrammetry and remote sensing which can be used in higher surveying.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Compute linear and areal measurements by using chain and compass.
CO 2	Gain the knowledge on levelling and contouring techniques and its applications.
CO 3	Apply the modern surveying techniques for various field problems
CO 4	Know the uses of total station instrument for different field applications
CO 5	Know the concepts of Phostogrammetry and Remote sensing

UNIT-I

Introduction to Surveying: Definition; Classification; Principles of surveying; Errors in surveying: Types of errors; Ranging, Principles of chain surveying; Basic definitions.
Compass Surveying: Prismatic compass, Surveyor's compass, Whole Circle and Quadrant Bearing, Included angles, and errors.

UNIT – II

Levelling: Different methods of levelling, Different types of level instruments, Levelling staff, Level field book, Reciprocal Levelling, Evaluation of Reduced Levels byRise and Fall Method, and Height of Instrument Method
Areas: Introduction; Simpson's rule; Boundaries with offsets at irregular intervals; coordinate method; level section; two level section; trapezoidal and prismoid rule.

UNIT – III

Modern Field Survey Systems: Principle of Electronic Distance measurement; types of EDM instruments, total station, parts, accessories – advantages and applications, field procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments.

UNIT – IV

PHOTOGRAMMETRIC SURVEYING: Introduction, Basic concepts, perspective geometry of aerial photograph, relief, and tilt displacements, and terrestrial photogrammetric

UNIT – V

REMOTE SENSING: Definition, Energy Principles, radiation principles, principles, and Use of EMR spectrum, Energy interactions in atmosphere- Scattering, Absorption, Energy interactions with h surface features and concepts of spectral reflectance curve.

Text Books:

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Surveying – Vol. I, II and III, Laxmi Publications (P) Ltd., 17th Edition, 2016.
2. R. Subramanian, Surveying and Levelling, Oxford University Press, 2nd Edition, 2012.
3. Chandra, A.M, Plane Surveying, 2nd Edition, New Age International Publishers, NewDelhi, 2010.
4. Surveying (Vol – 1, 2 & 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain -Laxmi Publications (P) ltd., New Delhi.

Reference Books:

1. S. K. Duggal, Surveying – Vol. I and II, Tata McGraw–Hill Publishing Co. Ltd., 4th Edition,2013.
2. Arthur R. Benton and Philip J. Taetz, Elements of Plane Surveying, McGraw-Hill, 3rdEdition,2010.
3. Arora, K. R., Surveying – Vol. I and II, Standard Book House, 14th Edition, 2011.
4. T. P. Kanetkar and S. V. Kulkarrni, Surveying and Levelling, Pune Vidyarthi GrihaPrakashan, Pune, 24th Edition, 2013.

Course Title	Traffic Engineering					B.Tech CE VII Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE112	**Open Elective (OEC IV)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 1.5 Hrs						**End Exam Duration: 3 Hrs**		

Course Objectives:
The objective of this course is to impart knowledge about various components and characteristics of traffic to understand concepts like Highway capacity and level of service concepts. To know various traffic control devices and principles of highway safety.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Conduct different engineering surveys required for highway planning and design
CO 2	Analyze the traffic flow patterns and delay patterns
CO 3	Understand the role and importance of various traffic control devices
CO 4	Know the impact of traffic on environmental pollution and standard pollution limits
CO 5	Understand the concepts of level of service of highways along with various highway systems required for traffic surveillance

UNIT – I
Components of the Traffic System
Human-Vehicle–Environment System; characteristics of Road users, Vehicles, Highways and their classification; Traffic Studies: Inventories; Volume studies; Speed, Accident studies.

UNIT – II
Traffic Characteristics
Microscopic and macroscopic flow characteristics: Time headways; Temporal, spatial and model flow patterns; Interrupted and Un interrupted traffic. Travel time and delay studies, Car-following theories.

UNIT – III
Traffic Control Devices & Highway Safety
Traffic signs & Markings; Signal Warrants; Signal phasing and Development of phase plans; Fixed and Vehicle activated signals; Accident characteristics – Road – Driver – Vehicle; Accident recording and Analysis; Highway Safety Improvement Program; Safety Audit.

UNIT – IV
Environmental Considerations
Air pollution: Kinds of pollutants; Air pollution standards; Measures of air quality; modelling and control. Noise pollution: Measurement of sound levels; Acceptable limits, Prediction of noise levels, Traffic noise control.

UNIT – V
Highway Capacity and Level of Service
Capacity and level of service; Factors affecting Capacity and LOS; Capacity of Rural

Highways, Capacity of Urban Roads;
Highway Systems: Traffic surveillance and monitoring; Intelligent vehicle highway system. IVHS programs, Role of IVHS, IVHS categories, Benefits and Costs of IVHS.

Text Books:

1. L R Kadiyali "Principles and Practice of Highway Engineering", Khanna Publishers, NewDelhi.
2. S K Khanna, C E G Justo and A Veeraragavan "Highway Engineering", Nemchand Publications, New Delhi.
3. Papacoastas, C. S. and Prevedouros, Transportation Engineering and Planning, ThirdEdition, Third Impression; Pearson Education, 2018.
4. Highway Engineering, Paul H. Wright and Karen K Dixon, Wiley Student Edition, WileyIndia (P) Ltd., New Delhi

Reference Books:

1. G V Rao "Principles of Transportation and Highway Engineering", Tata McGraw-HillCompanies, Inc. NewYork.
2. Partha Chakroborthy, Animesh Das, "Principles of Transportation Engineering", PrenticeHall of India, New Delhi.
3. S P Bindra "Highway Engineering", Dhanpath Rai & Sons, New Delhi.
4. Traffic & Highway Engineering by Nicholas J. Garber, Lester A. Hoel, Fifth Edition, published in 2015, CENGAGE Learning, New Delhi.

<table>
<tr><td>Course Title</td><td colspan="4">Basics of Power Electronics</td><td colspan="3">B. Tech. EEE
Open Elective - IV</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE207</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1Hr30M</td><td colspan="3">End Exam Duration 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to learn basic fundamentals of power electronics devices and to classify the different kinds of power electronics circuits as a function of the input source and loads.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="8">To understand the characteristics of different power switches.</td></tr>
<tr><td>CO 2</td><td colspan="8">To understand the single phase and three phase controlled rectifier with different loads</td></tr>
<tr><td>CO 3</td><td colspan="8">To understand the operating principle of cyclo converters, choppers and inverters</td></tr>
<tr><td>CO 4</td><td colspan="8">To understand harmonic content in output voltage and current waveforms of an inverter.</td></tr>
</table>

UNIT - I

Fundamentals of Power Semi-conductor devices: SCR – static characteristics –turn on and off mechanism – MOSFET, IGBT, GTO Characteristics.

UNIT - II

Phase controlled Rectifiers(AC to DC): Phase controlled rectifiers – single phase half and fully controlled converters – midpoint and bridge connections with R and RL loads – effect of source inductance- three phase half controlled converters with R load .

UNIT - III

AC Voltage Controllers (AC to AC): AC voltage controllers- single phase ac voltage controllers with SCR for R and RL load – cyclo converters – single phase cyclo converters (mid-point configuration) with R load.

UNIT - IV

Choppers (DC to DC): Choppers – principle of operation – control strategies- types of chopper circuits – type A, type B- buck -boost converter.

UNIT - V

Inverters (DC to AC): Inverters – single phase half bridge and full bridge inverters with R and RL load –output voltage control techniques - PWM techniques- harmonic reduction techniques.

Text Books

1. Power Electronics –M.D Singh & K.B. Kanchandhani, TMH publications, 1998.

2. Power Electronics - Circuits, Devices and Applications –M.H. Rashid, Prentice Hall of India, 2nd Edition 1998.

Reference Books

1. Power Electronics- P.S. Bimbhra, Khanna Publications.
2. Power Electronics –Vedam Subramanyam, New Age Information Limited, 3rd Edition.
3. Power Electronics –V.R. Murthy, Oxford University Press, 1st Edition – 2005.
4. Power Electronics –P.C Sen, Tata Mc Graw Hill Publishing.

<table>
<tr><td>Course Title</td><td colspan="4">System Reliability Concepts</td><td colspan="3">B. Tech. EEE
Open Elective - IV</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE208</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1Hr30M</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to learn basic probability theory, network modeling, time dependent probability, markov modeling and system reliability evaluation.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the concept of basic probability theory, binomial distribution, network reliability, reliability functions, time dependent probability, markov chains & process and system reliability</td></tr>
<tr><td>CO 2</td><td colspan="8">Apply probability rules to find probability distributions, network reliability for series, parallel, series-parallel, complex networks</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze the failure rate distributions, bath-tub curve, STPM, continuous markov process and frequency duration techniques for single and two repairable components</td></tr>
<tr><td>CO 4</td><td colspan="8">Evaluate transitional rates, cumulative probability and frequency n-component repairable models</td></tr>
</table>

UNIT-I

Basic Probability Theory: Basic concepts – Rules for combining Probabilities of events – Failure Density and Distribution functions – Bernoulli's trials – Binomial distribution – Expected value and standard deviation for binomial distribution – Examples.

UNIT-II

Network Modeling and Reliability Evaluation: Basic concepts – Evaluation of network Reliability / Unreliability – Series systems, Parallel systems, Series - Parallel systems, partially redundant systems – Types of redundancies - Evaluation of network Reliability / Unreliability using conditional probability method – Paths based and Cut set based approach – Examples.

UNIT-III

Time Dependent Probability: Basic concepts – Reliability functions f(t), F(t), R(t), h(t) – Relationship between these functions – Bath tub curve – Expected value and standard deviation of Exponential distribution – Measures of reliability – MTTF, MTTR, MTBF – Evaluation of network reliability / Unreliability of simple Series, Parallel – Examples.

UNIT-IV

Discrete Markov Chains: Basic concepts – Stochastic transitional Probability matrix (STPM) – Limiting State Probability evaluation – Absorbing states.

Continuous Markov Processes: Modeling concepts – State space diagrams – time dependent reliability evaluation of single component repairable model – Evaluation of Limiting State Probabilities of one, two component repairable models – Frequency and duration concepts – Frequency balance approach.

UNIT-V

Multi Component & Approximate System Reliability Evaluation: Recursive relation for evaluation of equivalent transitional rates, cumulative probability and cumulative frequency and 'n' component repairable model - Series systems, Parallel systems, Basic reliability indices – Cut-set approach – Examples.

Text Books

1. Reliability Evaluation of Engineering Systems by Roy Billinton and Ronald N. Allan, Reprinted in India B. S. Publications, 2007.
2. System Reliability Concepts by V. Sankar, Himalaya Publishing House, 2015.

Reference Books

1. Reliability Engineering by E. Balagurusamy, Tata McGraw Hill, 2003.
2. Reliability and Maintainability Engineering by Charles E. Ebeling, Tata McGraw Hill, 2000.

Course Title	Energy Auditing					B.Tech ME VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE314	**OEC- IV**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 90 Minutes					**End Exam Duration: 3Hrs**			

Course Objectives:

- Introduce the concepts of energy scenario and need for energy policy for industries in India.
- Familiarize with the Energy Audit concepts and its approaches.
- Teach the principles and objectives of the Energy management.
- Discuss the Thermal and Electrical Energy management.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Explain the fundamental aspects of energy scenario in India.
CO 2	List the various national and state level energy policy.
CO 3	Explain the concepts of energy conservation in boilers.
CO 4	Identify the thermal energy components.
CO 5	Explain the concepts of supply side methods to minimize supply.

UNIT – I

General Aspects

Review of energy scenario in India, General Philosophy and need of Energy Audit and Management, Basic elements and measurements - Mass and energy balances – Scope of energy auditing industries - Evaluation of energy conserving opportUNITies, Energy performance contracts, Fuel and Energy substitution, Need for Energy Policy for Industries, National & State level energy Policies.

UNIT-II

Energy Audit Concepts

Need of Energy audit - Types of energy audit – Energy management (audit) approach - understanding energy costs - Bench marking – Energy performance - Matching energy use to requirement - Maximizing system efficiencies -Optimizing the input energy requirements - Duties and responsibilities of energy auditors- Energy audit instruments - Procedures and Techniques.

UNIT – III

Principles and Objectives of Energy Management

Design of Energy Management Programmes - Development of energy management systems – Importance - Indian need of Energy Management - Duties of Energy Manager - Preparation and presentation of energy audit reports - Monitoring and targeting, some case study and potential energy savings.

UNIT - IV

Thermal Energy Management

Energy conservation in boilers - steam turbines and industrial heating systems - Application of FBC - Cogeneration and waste heat recovery -Thermal insulation - Heat exchangers and heat pumps –HVC industries-Building Energy Management.

UNIT - V

Electrical Energy Management

Supply side Methods to minimize supply-demand gap- Renovation and modernization of power plants - Reactive power management – HVDC- FACTS - Demand side - Conservation in motors - Pumps and fan systems – Energy efficient motors.

Text Books:

1. Murphy, W. R., Energy Management, Elsevier, 2007.
2. Smith, C. B., Energy Management Principles, Pergamum, 2007
3. Handbook of Energy Audit, Sonal Desai, Mcgraw Hill Education Private Ltd

Reference Books:

1.Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.

2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.
3. Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley a. Interscience publication)
4. Industrial Energy Management and Utilisation –L.C. Witte, P.S. Schmidt, D.R. Brown (Hemisphere Publication, Washington, 1988)
5. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982
6. Energy Conservation guide book Patrick/Patrick/Fardo (Prentice hall1993)

Course Title	Sustainable Engineering					B.Tech ME VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE315	OEC- IV	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs			

Course Objectives:

- To have an increased awareness among students on Issues in areas of sustainability.
- To understand the role of Engineering and technology within sustainable development
- To know the Methods ,tools and incentives for sustainable product service system development
- To Establish a clear understanding of the role and impact of various aspects of Engineering and emerging decisions on environmental, societal and economic problems

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the relevance and the concept of sustainability and the global initiatives in this Direction.
CO 2	Explain the different types of environmental pollution problems and their sustainable
CO 3	Discuss the environmental regulations and standards .
CO 4	Outline the concepts related to conventional and non-conventional energy
CO 5	Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles.

UNIT-I

Sustainability:

Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).

UNIT – II

Environmental Pollution:

Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming,
Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection.

UNIT – III

Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.

UNIT – IV

Resources and its utilization: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.

UNIT-V

Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy
efficiency in buildings, Green Engineering, Sustainable Urbanization, Sustainable cities, Sustainable transport

Text Books:

1.Sustainable Engineering: Drivers, Metrics, Tools, And Applications
Krishna R. Reddy, Claudio Cameselle, Jeffrey A. Adams.

2. Introduction to Sustainability for Engineers ByTulseeram, Ramjeawon

3. sustainable Engineering: Principles and Practice Hardcover – 13 June 2019 by Bhavik R. Bakshi

Reference Books:

1. Allen, D. T. and Shonnard, D. R., Sustainabilitngineering: Concepts, Design and Case Studies,PrenticeHall.

2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development,Cengageleaming

3. Environment Impact Assessment Guidelines, Notification of Government of India, 2006

4.Mackenthun, K. M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998

5. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System

Course Title	Industrial Engineering & Management				B.Tech ME VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE316	**OEC- IV**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 90 Minutes					**End Exam Duration: 3Hrs**			

Course Objectives:

- This course provides techniques of applying management principles to professional positions held by Engineers and Engineering Technologists
- The management functions, especially suited to scientist & Professionals in technical and industrial environment are part of the curriculum
- Students are exposed to the theory and practices of modern management approaches, tools and techniques in complex industrial & Competitive economic environment

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the concepts of Management, organization principles and also motivational qualities and leadership.
CO 2	Apply the knowledge where to and how to locate a plant, difficulties of plant layout.
CO 3	Evaluate various types of work studies processing charts and job evaluation techniques.
CO 4	Apply types of control charts and improvement of quality with analysis techniques.
CO 5	Use knowledge of management techniques in improving the Entreprise planning and project management.

UNIT-I

INTRODUCTION:

Concepts of Management and Organization – Functions of Management – Evolution of Management Thought : Taylor‟s Scientific Management, Fayol‟s Principles of Management, Douglas McGregor‟s Theory X and Theory Y, Mayo‟s Hawthorne Experiments, Hertzberg‟s Two Factor Theory of Motivation, Maslow‟s Hierarchy of Human Needs, Systems Approach to Management.

UNIT-II

PLANT LOCATION & LAYOUT:

Plant location, definition, factors affecting the plant location, comparison of rural and urban sites- methods for selection of plant.Types of production systems, Plant Layout – definition, objectives and types of plant layout.

UNIT-III

WORK STUDY:

Introduction, objectives of work study, steps in work study, purpose of method study, procedure of method study, recording techniques. Work measurement-purpose of work measurement, time studyprocedure-performance rating, standard time calculations (simple problems).

UNIT-IV

MATERIALS MANAGEMENT:

Objectives, Inventory – functions, types, associated costs, inventory controltechniques-ABC and VED analysis. Stores Management and Stores Records. Purchasemanagement duties ofpurchase of manager, associated forms, purchase procedure, methods of purchasing. Introduction to production planning and control (PPC) Objectives of PPC, Functions of PPC

UNIT-V

QUALITY CONTROL:

Meaning, process control, SQC control charts, single, double and sequential sampling, Introduction to TQM. Job Evaluation and merit rating: introduction-Job evaluation-objectives, benefits and limitations of job evaluation-methods of job evaluation.

Text Books:

1. DR. Ravi Shankar: Industrial Engineering and management/Galgotia publications pvt. Ltd.
2. Khanna O.P.: Industrial Engineering

Reference Books:

1. Industrial engineering and operations management by S.K. Sharma and Savita Sharma.
2. T.R. Banga : Industrial Engineering and Management
3. M. Mahajan: Industrial engineering and production management, DhanpatRai& Co.

<table>
<tr><td>Course Title</td><td colspan="5">Python Programming
(Open Elective Course -IV)</td><td colspan="3">B. Tech VII Sem (R20) CSE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE508</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Mins</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- Understand programming skills using basics of Python language
- Acquire basics of how to use collection data types of python language.
- To Introduce the object-oriented programming concepts.
- To understand Python Libraries NumPy and Pandas.
- To design a client server model using network Programming in python.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate and acquire knowledge on usage of Data types, operators, input and output statements in python programming.
CO 2	Identify the right sequences of python language in problem solving.
CO 3	Apply object-oriented features to solve real time applications
CO 2	Analyze the given problem and develop python program to solve the problem
CO 4	Able to use Numerical Python (NumPy) Libraryd for data processing.
CO 5	Apply network programming features of python for Internet applications

UNIT-I

Introduction: Data Types, Object References, Collection Data Types, Logical Operations, Control Flow Statements, Arithmetic Operators, Input/Output, Creating and Calling Functions.

UNIT-II

Collection Data Types: Sequence Types, Set Types, Mapping Types, Iterating and Copying Collections, Control Structures, Exception Handling, Custom Functions, Modules and packages.

UNIT-III

File Handling and OOP: Writing and Parsing Text Files, Object Oriented Approach, Concepts and Terminology, Attributes and Methods, Inheritance and Polymorphism, Using properties to control attribute access, creating complete fully integrated data types.

UNIT-IV

NumPy Basics: The NumPy ndarray, Creating ndarray, Data Types for ndarray, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Universal Functions, Data

Processing using Arrays.

UNIT-V

Introduction to Internet Programming: What is Client/Server Architecture? Sockets: Communication End points, Network Programming in Python: Socket() Module Function, Socket Object Built-In Methods, creating a TCP Server, creating a TCP Client. [Text Book 4]

Text Books:

1. Programming in Python 3, A complete Introduction to Python Language by Mark Summerfield, Pearson Publications, second edition, 2018
2. Core python programming by Wesley J Chun, Prentice Hall, Second edition.
3. Python for Data Analysis by Wes McKinney, O'Reilly, First Edition.
4. Core Python Applications Programming by Wesley J. Chun, Third Edition.

Reference Books:

1. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher.
2. Learning python, Mark Lutz, O'Reilly publications,5th edition, 2013
3. Python: The complete reference by Martin C Brown, McGraw-Hill Publication, 2018.
4. Core python programming by Dr. R. Nageswara Rao, Dreamtech press, second edition, 2018.

<table>
<tr><td>Course Title</td><td colspan="5">Cloud Computing
(Open Elective Course -IV)</td><td colspan="3">B.Tech VII Sem (R20) CSE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE509</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To explain the history of different computing paradigms.
- To Know about issues and virtualization in cloud
- To introduce the various levels of Cloud Services and applications that can be achieved by the cloud.
- To know about cloud access and security issues.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Recall different Computing Paradigms and overview of cloud computing.
CO 2	Understanding the Cloud Computing Architecture, network connectivity and cloud migration strategy.
CO 3	Explain and characterize different cloud deployment models, service models.
CO 4	Understanding virtualization, Programming models and Software Development in Cloud Computing.
CO 5	Understanding Cloud Service Providers AWS and Microsoft cloud Services.

UNIT-I

Computing Paradigms, Cloud Computing Fundamentals, Motivation for Cloud Computing: The Need for Cloud Computing. Defining Cloud Computing: NIST Definition of Cloud Computing, Computing Is a Service, Cloud Computing Is a Platform. Principles of Cloud computing: Five Essential Characteristics, Four Cloud Deployment Models, Three Service Offering Models, Cloud Ecosystem, Requirements for Cloud Services, Cloud Application, Benefits and Drawbacks.

UNIT-II

Cloud Computing Architecture and Management: Cloud Architecture, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Migrating Application to Cloud.

UNIT-III

Cloud Deployment Models: Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud.

Cloud Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models.

UNIT-IV

Virtualization: Introduction, Virtualization opportunities, Approaches to Virtualization, Hypervisors, From Virtualization to cloud computing.

Programming Models in Cloud: Cloud Application Development Platforms: Windows Azure, Google App Engine, Force.com, Manjrasoft Aneka.

Software Development in Cloud: Introduction, Different perspectives on SaaS development, New challenges, Cloud aware software development using PaaS technology.

UNIT-V

Cloud Services : Using Amazon Web Services – Understanding AWS, AWS Components and Services, Working with the Elastic Compute Cloud (EC2), Amazon Storage Systems, Amazon Database Services, Using Microsoft Cloud Services – Exploring Microsoft Cloud Services, Defining the Windows Azure Platform.

Text Books:

1. Barrie Sosinsky, “Cloud Computing Bile” ,Wiley publishing.
2. Judith Hurwitz, R Bloor, M.Kanfman, F.Halper “Cloud Computing for Dummies”, Wiley India Edition, First Edition.
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, ”Cloud Computing: Principles and Paradigms”, Wiley Publication,2011.
4. K.Chandrasekaran, Essentials of Cloud Computing, CRC Press, 2015.

Reference Books:

1. Danielle Ruest and Nelson Ruest, “Virtualization: A Beginners’s Guide”, McGraw Hill, 2009.
2. Tom White, “Hadoop: The Definitive Guide”, O’RIELLY Media 2009.
3. Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems and Applications, Springer, 2012.

<table>
<tr><td>Course Title</td><td colspan="3">DATA ANALYTICS WITH PYTHON
(Open Elective Course – IV)</td><td colspan="4">B.Tech. VII Sem (R20UG) AI&ML</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE3907</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- Understand programming skills using basics of Python language
- To introduce the object-oriented programming concepts.
- Acquire basics of how to translate problem into object-oriented form
- To understand object-oriented programming concepts, and apply them in solvingproblems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate and acquire knowledge on usage of Data types, operators, input andoutput statements in python programming.
CO 2	Analyze the given problem and develop python program to solve the problem.
CO 3	Able to use proper iterative statements in problem solving.
CO 4	Entity the right sequence to solve the real-world problems.
CO 5	Apply object-oriented features to solve real time applications.

UNIT - I

Features of python, Execution of a python program, comments, identifiers and variables, classification of data types, keywords, constants, Naming conventions in python, Operators andexpressions, operator precedence and associativity, input and output statements.

UNIT - II

Control statements: simple if, if..else, nested if, if..elif..else statement. **Loops:** while loop, for loop, nested loops, break, continue, pass and assert statements, Arrays in python, Strings and their operations.

UNIT - III

Functions: define and calling a function, return statement, formal and actual arguments, local and global variables, passing arguments to function, anonymous functions, example programs on functions, recursion.

UNIT - IV

Sequences: Lists, Tuples, Sets, Dictionaries, Operations and methods on Tuples, Lists, Dictionaries.
Files: Types of files, opening file, closing a file, write data into a file, read data from a file.

UNIT - V

Introduction to OOPS: Introduction to class and objects, self-variable in python, constructor, types of variables and methods, Inheritance and polymorphism, abstract class.

Text Books:

1. Core python programming by Wesley J Chun, Prentice Hall, Second edition.
2. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher.
3. Learning python, Mark Lutz, O'Reilly publications, 5th edition, 2013.
4. Core python programming by Dr. R. Nageswara Rao, Dreamtech press, second edition, 2018

Reference Books:

1. Python: The complete reference by Martin C Brown, McGraw-Hill Publication, 2018.
2. Programming Python, Mark Lutz,4th Edition, O'Reilly publications.
3. Dive into Python, Mark Pilgrim, A Press Media, LLC.

<table>
<tr><td>Course Title</td><td colspan="4">WEB DESIGNING USING PHP
(Open Elective Course – IV)</td><td colspan="4">B.Tech. VII Sem (R20UG) AI&ML</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE3908</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• Familiarize the tags of HTML.
• Write backend code in PHP language and writing optimized front end code HTML and Java Script.
• Understand, create and debug database related queries and Create test code to validate the applications against client requirement.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO1</td><td colspan="8">Enumerate the Basic Concepts of Markup Languages.</td></tr>
<tr><td>CO2</td><td colspan="8">Develop web Applications using CSS and different page layout.</td></tr>
<tr><td>CO3</td><td colspan="8">Make use of decisions, loops, strings in PHP</td></tr>
<tr><td>CO4</td><td colspan="8">Make use of functions, creating HTML forms with PHP.</td></tr>
<tr><td>CO5</td><td colspan="8">Accessing database through PHP.</td></tr>
</table>

UNIT – I

Structuring Documents for the Web: Introducing HTML and XHTML, Basic Text Formatting, Presentational Elements, Phrase Elements, Lists, Editing Text, Core Elements and Attributes, Attribute Groups.

Links and Navigation: Basic Links, Creating Links with the Element, Advanced E- mail Links.

Images, Audio, and Video: Adding Images Using the error! File name not specified Element, Using Images as Links Image Maps, Choosing the Right Image Format, Adding Flash, Video and Audio to your web pages.

Tables: Introducing Tables, Grouping Section of a Table, Nested Tables, Accessing Tables.

Forms: Introducing Forms, Form Controls, Sending Form Data to the Server.

Frames: Introducing Frameset, Element, Creating Links between Frames, setting a Default Target Frame Using Element, Nested Framesets, Inline or Floating Frames with.

UNIT – II

Cascading Style Sheets: Introducing CSS, where you can Add CSS Rules.

CSS Properties: Controlling Text, Text Formatting, Text Pseudo Classes, Selectors, Lengths, Introducing the Box Model.

More Cascading Style Sheets: Links, Lists, Tables, Outlines, the focus and activate Pseudo classes Generated Content, Miscellaneous Properties, Additional Rules, Positioning and Layout with CSS.

Page Layout: Understating the Site's Audience, Page Size, Designing Pages, coding your Design, Developing for Mobile Devices.

Design Issues: Typography, Navigation, Tables, Forms.

UNIT – III

Introducing PHP – What is PHP? Why PHP use? Evolution of PHP, Installing PHP, Other ways to run PHP, Creating your first script.

PHP Language Basics – Using variables, Understanding Data Types, Operators and Expressions, Constants.

Decisions and Loops – Making Decisions, Doing Repetitive Tasks with Looping, Mixing Decisions and Looping with HTML.

Strings – Creating and Accessing Strings, Searching Strings, Replacing Text with Strings, Dealing with Upper and Lowercase, Formatting Strings.

UNIT – IV

Arrays – Creating Arrays, Accessing Array Elements, Looping Through Arrays with for-each, Working with Multidimensional Arrays, Manipulating Arrays.

Functions – What is a Function? Why Functions are useful? Calling Functions, Working with Variable Functions, writing your own Functions, Working with References, Writing Recursive Functions.

Handling HTML Forms with PHP – How HTML form works, Capturing Form Data with PHP, Dealing with Multi-Value Fields, Generating Web Forms with PHP, Storing PHP Variables in Forms, Creating File Upload Forms, Redirecting After a Form Submission.

UNIT – V

Working with Files: Getting Information on Files, Opening and Closing Files, Reading and Writing to Files, Copying, Renaming, and Deleting Files.

Working with Databases and MySQL – Database Architectures, Database Models, Starting the MySQL Server, Setting Up the MySQL root Password, making a Connection, choosing a Database, creating a New Database, Reading Data, creating a Table, Adding Data to a Table, Reading Data from a Table, Updating Data in a Table, Deleting Data from a Table, Deleting Tables and Databases, Handling Errors.

Text Books:

1. Jon Duckett, Beginning HTML, XTML, CSS and JavaScript
2. Matt Doyle, Beginning PHP 5.3 (Wrox – Wiley Publishing)

Reference Books:

1. Chris Bates, Web Programming
2. Ralph Moseley and M. T. Savaliya, Developing Web Applications
3. P.J. Deitel & H.M. Deitel, Internet and World Wide Web How to program
4. W. Jason Gilmore, Beginning PHP and MySQL From Novice to Professional

<table>
<tr><td>Course Title</td><td colspan="4">OPERATIONS RESEARCH (R20)</td><td colspan="3">OPEN ELECTIVE - IV</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE617</td><td rowspan="2">Open Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hours</td></tr>
<tr><td colspan="9">Course Objectives:
The course is intended to identify and develop operations research models, understand the mathematical tools to solve optimization problems and develop a report that describes the model, the solving techniques and analyze the results.</td></tr>
<tr><td colspan="9">Course Outcome: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand various concepts of Operations research.</td></tr>
<tr><td>CO 2</td><td colspan="8">Apply linear programming to optimization techniques.</td></tr>
<tr><td>CO 3</td><td colspan="8">Discuss Transportation problem.</td></tr>
<tr><td>CO 4</td><td colspan="8">Solve Assignment problem.</td></tr>
<tr><td>CO 5</td><td colspan="8">Distinguish a game situation from a pure individual's decision problem and to explain concepts of players, strategies, payoffs, rationality.</td></tr>
</table>

UNIT I: Introduction to Operations research

Introduction, Models of Operations research, Advantages of Operations research, Limitations of Operations research

UNIT II: Linear Programming

Linear programming, Assumptions of linear programming, Properties of linear programming solution, Development of LP models, Graphical method, Simplex method.

UNIT III: Transportation Problem

Transportation problem, Mathematical model for transportation problem, Types of transportation problem, Starting solutions: North- West corner rule, Least cost method, Vogel's approximation method.

UNIT IV: Assignment Problem

Assignment problem – Hungarian method.

UNIT V: Game Theory

Introduction to Game Theory, Properties of a Game, Characteristics of Game Theory, Classification of Games, The Maximin-Minimax Principle, Two-Person and Zero-Sum Game, Games with Mixed Strategies, Method of finding out odds.

Text books:

1. Operations Research by N.K.Tiwari, Shishir K. Shandilya Prentice-Hall of India.
2. Operations Research by R. Pannerselvam, PHI Publications, 2nd Edition, 2012

3. Fundamentals of Operations Research, Prism publishers, Ackoff Russell LSasieni Maurice W.
4. Introduction to Operations Research, Cengage Publishers, Ecker Joseph Gkupferschmid Michael.

Reference Books:

1. Engineering Optimization by Singiresu S. Rao New Age International Publishers.
2. Operations Research by Kanthi Swarup, P.K.Gupta and Manmohan, S. Chand & Sons, 2004.
3. Introduction to Operations Research, TMH Publishers, Hiller Fredrick S, Lieberman Gerald J, Nag Bodhibr.
4. Introduction to Operations Research a Computer Oriented algorithmic, Gillett Billy E.

<table>
<tr><td>Course Title</td><td colspan="5">FUNDAMENTALS OF QUANTUM COMPUTATION AND NANO PHOTONICS</td><td colspan="3">OPEN ELECTIVE - 4</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">180E2618</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End lab Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

COURSE OBJECTIVES:

1. This course outlines physically the intuitive concepts of quantum computation and nanophotonics using the concept of optical near-fields.
2. 2.Physics of information processing; quantum error correction; quantum communication, Optical near-field is an electromagnetic field that mediates the interaction between nanometric materials used for the realization of novel photonic devices, fabrication techniques, and systems.
3. Prior knowledge of quantum mechanics and photonics is helpful.

Course Outcomes: Upon completion of the course, the student will be able to:

CO1	**Explain** the concepts of Quantum mechanics.
CO2	**Understanding** the basic concepts of quantum computation.
CO3	**Identify** the different implementations of quantum computers.
CO4	**Analyze** the nanophotonics and its true nature
CO5	**Classify** the Interconnections for nanophotonics

UNIT –I: Quantum Mechanics

Introduction to Matter Waves - de Broglie Hypothesis - Heisenberg Uncertainty Principle - Schrodinger's time independent wave equation - Significance of wave function.

UNIT –II: Quantum Computing

Basic concepts of quantum mechanics – Stern - Gerlach Experiment - Qubits – Measurements – Gates - Quantum no-cloning and Teleportation.

UNIT -III: Error Correction and Implementations

Quantum Error-Correction - three-qubit bit flip code - five-qubit code - General properties of quantum error-correction.
First Experimental Implementations - Quantum optics implementations -NMR quantum information processing.

UNIT -IV: Nanophotonics

Photons and Electrons: Similarities and Differences - Confinement – Propagation-free space, Forbidden Zone: Tunneling.

UNIT – V: Nanophotonic systems

Nanotechnology- Photonics - Nanophotonics - Optical Nanomaterials - Nanoparticle Coatings - Sunscreen Nanoparticles - Self-Cleaning Glass - Fluorescent Quantum Dots – Nanobarcodes.

Text Books:

1. Quantum Computing Basics and Concepts by **S. M. Girvin - arXiv , 2013**
2. *Principles of Nanophotonics by* Motoichi Ohtsu, Kiyoshi Kobayashi, Tadashi Kawazoe, Takashi Yatsui and Makoto Naru -New York, USA: CRC Press-Taylor & Francis Group, 2008.
3. Paras. N. Prasad, Nanophotonics. New Jersey, USA:John Wiley & Sons Inc.,2004

Reference Books:

1. Quantum Computing by **John Watrous - University of Calgary , 2006**
2. Basic Concepts in Quantum Computing by **Artur Ekert, Patrick Hayden, Hitoshi Inamori – ar Xiv , 2000**
3. An Introduction to Quantum Computing for Non-Physicists" Eleanor Rieffel FX Palo Alto Labratory and Wolfgang Polak Consultant FX Palo Alto Laboratory.

<table>
<tr><td>Course Title</td><td colspan="5">Green Chemistry and Technology</td><td colspan="3">B. Tech.
(Open Elective-IV)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE619</td><td rowspan="2">Open Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To make students aware of how chemical processes can be designed, developed and run in a sustainable way.
o Students acquire the competence to think of chemistry as a sustainable activity</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the tolls & Principles of Green Chemistry</td></tr>
<tr><td>CO 2</td><td colspan="8">Knowledge of applications of green routes for synthesis of chemicals</td></tr>
<tr><td>CO 3</td><td colspan="8">Synthesis of biocatalysts using different techniques</td></tr>
<tr><td>CO 4</td><td colspan="8">Analyze about trends of solvent free chemical reactions</td></tr>
<tr><td>CO 5</td><td colspan="8">Better realization about reflections of Green Chemistry on sustainable development initiatives.</td></tr>
</table>

Unit-1: Fundamentals of Green Chemistry:
Discussion of the current state of chemistry and the environment and the definition of green chemistry. An introduction to the tools of green chemistry and its fundamental principles.
Learning Outcomes:
After completing this unit, the student will be able to
- Summarize the principles in green chemistry.
- Understand the importance of green chemistry in future development

Unit-2: Principles of Green Chemistry:
Prevention of waste / by-products, Hazardous products Designing of safer chemicals-Selection of appropriate solvents and starting materials- Use of protecting groups and catalysis- Designing of biodegradable products.
Learning Outcomes:
After completing this unit, the student will be able to
- Explain the importance of designing of safer chemicals.
- Interpret the need for selection of appropriate solvents and starting materials in chemical reactions.

UNIT-3: Catalysis for Green Chemistry:
Use of biocatalysts- Biochemical Oxidation, Biochemical Reduction, Modified biocatalysts- transition metal catalysis-Simmons-Smith reaction, Heak reaction, Ullmann's coupling.
Learning Outcomes:
After completing this unit, the student will be able to
- Know the use of biocatalysts.
- Explain transition metal catalysis reactions

UNIT-4: Synthesis of green chemistry

a) Solvent Free Reactions: Solvent free techniques- Reactions on solid mineral supports, Phase Transfer Catalysis- C-alkylation, N-alkylation.
b) Ultrasound assisted green synthesis Introduction to ultrasound assisted green synthesis, Hydroboration, Bouveault reaction.

Learning Outcomes:
After completing this unit, the student will be able to

- Explain solvent free reactions in green synthesis
- Understand the importance of ultrasound assisted Green synthesis

UNIT-5: Applications of Green Chemistry
Importance of Green chemistry in Sustainable development. Applications in Pharmaceutical Industry, Nanoscience, Chemical industry, Colour, Paper, polymer, Solar cells & in agriculture field.

Textbooks:

1. Engineering Chemistry, Fundamentals and Applications, Shikha Agarwal
2. Green Chemistry: Theory & Practice, Oxford University Press, Oxford publication, 1998
3. Green chemistry, Stanley E. Manahan, ChemChar Research, Inc publishers 2005.
4. Introduction to Green Chemistry, Second edition, Albert Matlack, CRC Press 2016

References:

1. Text Book of Engineering Chemistry by S.S. Dara & Mukkati S. Chand & Co Publishers, New Delhi, 2006.
2. Handbook of Green chemistry and technology, James H. Clark, Duncan J. MacQuarrie, Blackwell, Abingdon,2002
3. An Introduction Text on Green Chemistry, Indu Tucker Sidhwani, Rakesh K. Sharma, Wiley Publications
4. Green Organic Chemistry in Lecture and laboratory, Andrew P. Dicks & Michael C. Cann, T& F India publications.

Course Title	Creative Writing					OPEN ELECTIVE – IV		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE620	**HUM**	**L**	**T**	**P**	**C**	**Internal Assessment**	**External Exams**	**Total**
		3	0	0	3	40	60	100
Mid Exam: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To acquaint the learners with ideas related to creative writing including the art, the craft and the basic skills required for a creative writer
- To help learners to understand the principles of creative writing and the distinction between the literary genres
- To explain the differences in writing for various literary and social media
- To hone the creative and critical faculties of learners
- To enable learners to put into practice the various forms of creative writing that they have studied through the course

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Distinguish between the literary genres
CO 2	Write for various literary and social media
CO 3	Critically appreciate various forms of literature
CO 4	Make innovative use of their creative and critical faculties
CO 5	Seek employment in various creative fields

Unit I: Fundamentals of Creative Writing: (6 Hours)

Meaning and Significance of Creative Writing - Genres of Creative Writing: poetry, fiction, non-fiction, drama and other forms - Research for Creative Writing

Unit II: Elements of Creative Writing :(8 Hours)

Main elements of creative writing- Vocabulary improvement- often used Latin expressions in English- Idiomatic expressions.

Unit III: Forms of Creative Writing: (8 Hours)

Dialogue writing - Note making/Note taking - Short story writing - Expansion of an Idea / Proverb -Creative writing for marketing - Self-Narrative Writing

Unit IV: New Trends in Creative Writing (8 Hours)

Web Content Writing and Blog Writing- Script Writing- Journalistic Writing – Copywriting-

Graphic Novel- Flash Fiction

Unit V: Figurative Language

Literary Devices- Importance of figurative language in creative writing- Most common literary devices- Remedial grammar.

References:

- Creative Writing: A Beginner's Manual AnjanaNeira Dev. AnuradhaMarwah, Swati Pal Delhi,
  Pearson Longman, 2009.
- Abrams, M.H. Glossary of Literary Terms. Boston: Wadsworth Publishing Company,2005.
- Elements of Literature: Essay, Fiction, Poetry, Drama, Film. Robert Scholes, Nancy R. Comley, Carl H. Klaus, Michael Silverman Delhi, OUP, 2007.
- Write from the Heart: Unleashing the power of Your Creativity. Hal ZinaBennet California, New World Library,2001.
- A Guide to Writing about Literature, Sylvan Bamet, William E.Cain, New Delhi, Pearson, 2006.
- Atwood, Margaret. Negotiating with the Dead: A Writer on Writing. Cambridge: CUP,2002.
- Bell, Julia and Magrs, Paul. The Creative Writing Course-Book. London: Macmillan,2001.
- Earnshaw, Steven (Ed). The Handbook of Creative Writing. Edinburgh: EUP, 2007.
- Show, Mark. Successful Writing for Design, Advertising and Marketing. New York: Laurence King, 2012.
- Sugrman, Joseph .The Adweek Copywriting Handbook: The Ultimate Guide to WritingPowerful Advertising and Marketing Copy from One of America's Top Copywriters. NewYork: Wiley, 2009.

Cyber Resources:

http://www.chillibreeze.com/articles_various/creativewriter.asp

http://www.contentwriter.in/articles/writing/

http://www.cbse.nic.in/cw-xii/creative-writing-xii-unit-1.pdf.

<table>
<tr><td>Course Title</td><td colspan="4">Materials Management</td><td colspan="3">B. Tech.
Open Elective - IV</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20OE621</td><td rowspan="2">Open Elective (OEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 90 Min</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives: The objective of the course is

- To understand how the knowledge of materials management can be an advantage to logistics and supply chain operations.
- To sensitize the students on the materials management functions – Planning, Purchase, Controlling, Storing, Handling, Packaging, Shipping and Distributing, and Standardizing
- To realize the importance of materials both in product and service.
- Use of TQM, JIT and SCM in managing materials.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Remembering the concepts of purchases, vendors, materials handling, inventory types etc.
CO 2	An understanding of basic concepts in Materials management and modern trends inmaterials management
CO 3	Analyze the processes of vendor management, material handling, ABC analysis andEOQ etc...
CO 4	An understanding of principle of materials handling and evaluation of material handling performance.
CO 5	Able to apply the techniques of inventory management.

Unit - I

Purchase Management: Overview, Purchase organization, Ethical Concepts in purchases, PurchaseParameters, purchase Methods. International Purchasing, International purchasing procedure.

Unit - II

Vendor Management: Vendor Evaluation - factors, advantages and disadvantages, parameters. Vendormanagement process. Recent trends in Vendor management

Unit - III

Materials Handling: Handling Principles, handling costs, unit load concept, flow pattern, materialhandling equipment's, evaluation of materials handling performance, safety in materials handling.

Unit - IV

Inventory Management: Types of Inventory, Costs Associated with Inventory, Inventory Control, Selective Inventory Control, Economic Order Quantity, ABC Analysis, Safety Stocks, Inventory Management Systems, Forecasting Techniques, Material Requirement Planning.

Unit - V

Computers in Materials Management: Introduction, Role of Computers in Materials Management: Advantages and Disadvantage of Computer in Materials Management, Materials Planning: Need for Materials Planning, Techniques of Materials Planning.

Text Book:

Material Management by K. ShridharaBhat

Reference Books:

1. Purchasing and Materials Management, P Gopalkrishnan,

2. Materials Management - An Integrated Approach, P Gopalkrishnan, M. Sundaresan, PHI.

3. Materials Management, Procedures, Text and Cases, A K Datta, PHI.

4. Production & Operation Management by K Ashwathappa, K ShridharaBhat

B.Tech VIII SEM ECE (R20)

<table>
<tr><td>Course Title</td><td colspan="4">Project Work/Internship</td><td colspan="3">B.Tech VIII Sem (R20) ECE</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2004801</td><td rowspan="2">PROJ</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>12</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Internal Assessment:40</td><td colspan="4">External Assessment:60</td></tr>
</table>