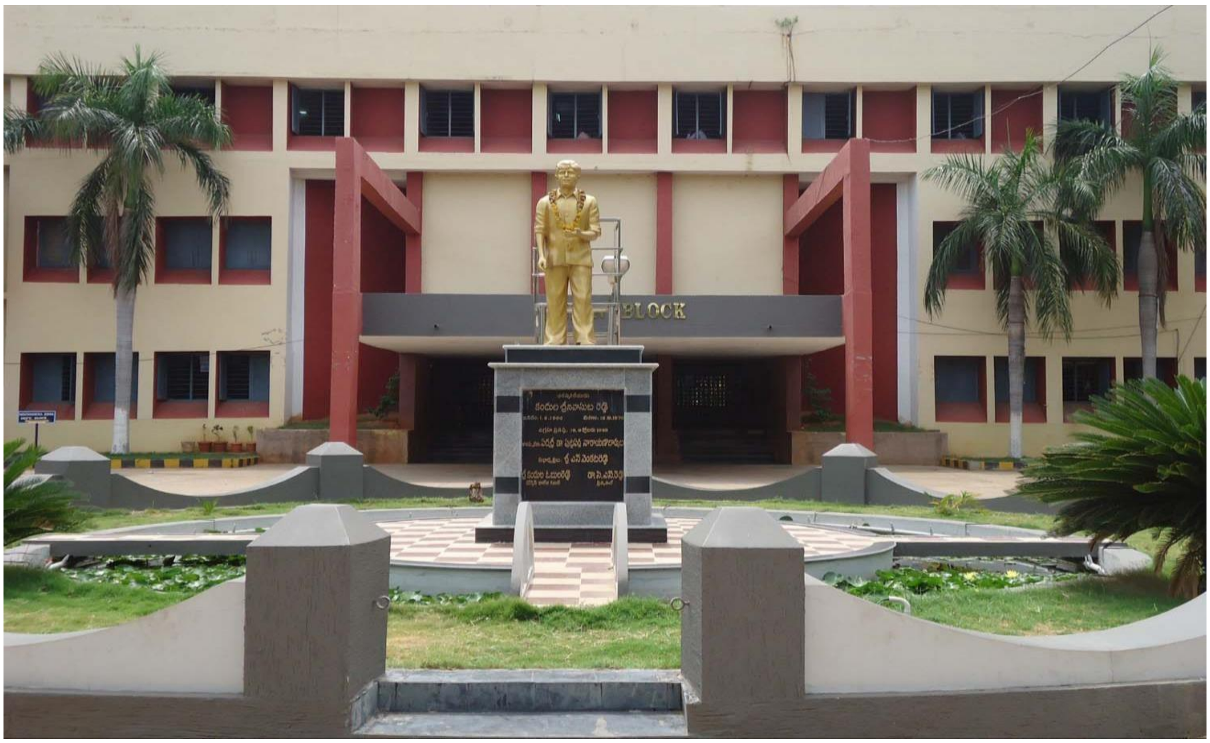
Regulations, Curriculum and Syllabus for

UG Programs in Engineering (R20UG)

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

CIVIL 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 CIVIL ENGINEERING

VISION & MISSION

VISION:

To become the frontrunner in the field of civil engineering and tackle national and global challenges that aligns with the needs of the society

MISSION:

M1: To provide value added education and cope up with the changes through innovative and dynamic curriculum

M2: To engage in research that creates state-of-the-art technologies and futuristic knowledge, with a strong emphasis on meeting the socio-economic requirements of the society

M3: To produce globally competent professionals with leadership skills, team work and ethical conduct

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1 – To excel in professional career in the industry or to be a successful entrepreneur to create a sustainable built environment.

PEO2 – To pursue higher education and involve in research with zeal for lifelong learning.

PEO3 – To demonstrate leadership qualities, ethical values and environmental awareness to serve the society

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 graduates in Civil Engineering will be able to

PSO 1: Analyze, Design, Construct, Maintain and Operate infrastructural projects.

PSO 2: Assess the environmental impact of various projects and take required measures to curb environmental deterioration.

PSO 3: Use latest software pertaining to various streams of Civil Engineering.

KSRM College of Engineering (Autonomous), Kadapa-516005, AP

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

Index

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 four academic 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 each branch 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. The credits assigned to subjects shall be given in curriculum. The total number of credits for entire course is 160 for all branches.

5.5 *Curriculum and Syllabus*: The curriculum and syllabus for first and second semesters is 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 in designing 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 allowed to 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 listed in curriculum and additional subjects required for achieving honours/ minor degree. Excepting first semester, the registration for a semester shall be done during a specified week after end examinations of previous semester. In first semester, the registration 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 six working 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 to that semester, ii) has cleared all fees to the Institute, library and hostel of previous semester, 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 for internal 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 zero marks for that midterm test. If any student fails to submit any assignment within 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 questions and all questions shall be answered. However, each question can have internal choice (either or type question). Generally, each question shall test one 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. While some questions may test student's understanding of the subject, there shall be questions that imply connect to real world applications. A variety of questions can 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 are obtained 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. Late submissions 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 be done 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, and comprehensive 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 be evaluated 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 letter grade 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 a subject 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 all credit-bearing subjects of a semester. SGPA is calculated as the weighted average of Grade 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 semester and 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 E in that subject. If a student receives fail grade F or *Ab* in any subject, she or he must register 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 the opportunity arises and pass that subject. The supplementary exam will be conducted for 30 marks covering the entire syllabus and student is deemed to have passed in the subject if she or he earns 12 marks (40% marks) in the supplementary exam, 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 or he fulfils the attendance requirement.

10.2 A student shall be promoted from current semester to succeeding semester on satisfying 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 a semester 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-periods conducted 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 less than 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 the performance 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 at least 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 markswill 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 two MOOCs, 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 the concerned 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 all semesters, 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 bythe 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.

THREE WEEK INDUCTION PROGRAM

Introduction

The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfil his responsibility as an engineer, a citizen and a human being. Besides the above, several meta- skills and underlying values are needed.

1. Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose.

We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labor yields fruits from nature.

2.2 Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, music, dance etc. The student would pursue it every day for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

2.3 Universal Human Values

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self.

2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses.

2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

2.8 Familiarization to Dept. / Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

Amendments to R20 UG Regulations :-

1. Skill courses shall be conducted from III Sem to VI Sem.
2. Internships/ Socially relevant projects, which can be conducted during IV Sem& V Sem break, VI Sem & VII Sem break and the same may be evaluated during V & VII semesters.
3. The eligibility criteria for Minor/ Honor degree is minimum CGPA of 8.0 and no backlogs, reckoned up to III semester.
4. Minimum CGPA of 7.5 with no backlogs up to III semester for registration of Minor and honor degree for SC/ST students.
5. The respective departments shall give a list of standard MOOCs providers including SWAYAM whose credentials are endorsed by respective Chairman Board of Studies.
6. He/ She has to obtain a certificate from the provider in which he/ She has registered

and submit the same to the concerned department.

7. Any MOOC course selected by the student shall be of 12 weeks course with 3 credits and also from the reputed provider.
8. If provider explicitly declares letter grade, pass or fail and credits of that particular course, the letter grade can be converted to grade point as per the table given below:

Absolute Marks	**Letter Grade**	**Grade Points assigned**	**Remark**
≥ 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

9. In case of any deviation in the above clause, the committee appointed by the Principal shall take a decision for converting MOOC results into the relevant grade points.
10. Credits awarded in the MOOC certificate are directly transferred to the grade sheet.
11. If the student fails to complete the MOOCs he/ she has to write two internal tests besides the End examinations conducted by the Institute (offered in place of MOOCs by the department) like other subjects.

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 CIVIL ENGINEERING

VISION & MISSION

VISION:

To become a frontrunner in the field of Civil Engineering, and tackle national and global challenges that aligns with the needs of society.

MISSION:

M1: To provide value added education and cope up with the changes through innovative and dynamic curriculum.

M2: To engage in research that creates state-of-the-art technologies and futuristic knowledge, with a strong emphasis on meeting the socio-economic requirements of society.

M3: To produce globally competent professionals with leadership skills, team work and ethical conduct.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1: To excel in professional career in the industry or to be a successful entrepreneur to create a sustainable built environment.

PEO2: To pursue higher education and involve in research with zeal for lifelong learning.

PEO3: To demonstrate leadership qualities, ethical values and environmental awareness, to serve the society.

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 graduates in Civil Engineering will be able to

PSO 1: Analyze, Design, Construct, Maintain and Operate infrastructural projects.

PSO 2: Assess the environmental impact of various projects and take required measures to curb environmental deterioration.

PSO 3: Use latest softwares pertaining to various streams of Civil Engineering.

CIVIL 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	20EP102	Engineering Physics	BSC	3	0	0	40	60	3
3	2024103	Communicative English	HSMC	3	0	0	40	60	3
4	2014104	Basic Electrical & Electronics 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	20EP107	Engineering Physics Lab	BSC	0	0	3	40	60	1.5
8	2024108	Communicative English Lab	HSMC	0	0	3	40	60	1.5
9	2014109	Basic Electrical & Electronics 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	20EC202	Engineering Chemistry	BSC	3	0	0	40	60	3
3	2005203	C-Programming & Data Structures	ESC	3	0	0	40	60	3
4	2001204	Strength of Materials	ESC	3	0	0	40	60	3
5	20EW205	Engineering Workshop	LC	0	0	3	40	60	1.5
6	2005206	IT Workshop	LC	0	0	3	40	60	1.5
7	20EC207	Engineering 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	2001209	Strength of Materials 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	2021302	Probability, Statistics & Numerical Methods	BSC	3	0	0	40	60	3
2	2001302	Geology and Building materials	ESC	3	0	1	40	60	3.5
3	2001303	Advanced Strength of materials	PCC	3	1	0	40	60	4
4	2001304	Fluid Mechanics	PCC	3	0	0	40	60	3
5	2001305	Geomatics	PCC	3	0	0	40	60	3
6	2001306	Fluid Mechanics Laboratory	PCC (LAB)	0	0	3	40	60	1.5
7	2001307	Geomatics Lab	PCC (LAB)	0	0	3	40	60	1.5
8	20013S1	Civil Engineering Workshop **(Skill oriented)**	SOC	1	0	2	40	60	2
Total				**16**	**1**	**9**	**320**	**480**	**21.5**

IV Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2025401	Business Economics and Accounting for Engineers	HSS	3	0	0	40	60	3
2	2001402	Hydraulics & Hydraulic Machinery	PCC	3	0	0	40	60	3
3	2001403	Soil Mechanics	PCC	3	0	0	40	60	3
4	2001404	Structural Analysis	PCC	3	0	0	40	60	3
5	2001405	Transportation Engineering	PCC	3	0	0	40	60	3
6	2001406	Building Planning and Drawing (AutoCAD)	BSC (LAB)	0	0	3	40	60	1.5
7	2001407	Soil Mechanics Laboratory	PCC (LAB)	0	0	3	40	60	1.5
8	2001408	Transportation Engineering Laboratory	PCC (LAB)	0	0	3	40	60	1.5
9	20014S2	Advanced Civil Engineering Workshop **(Skilloriented-2)**	SOC	1	0	2	40	60	2
10	2024410	Universal Human Values	HSMC	3	0	0	40	60	3
Total				**19**	**0**	**11**	**400**	**600**	**24.5**

V Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2001501	Hydrology & Irrigation	PCC	3	0	0	40	60	3
2	2001502	Foundation Engineering	PCC	3	0	0	40	60	3
3	2001503	Concrete Technology	PCC	3	0	0	40	60	3
		PEC-I							
4	2001504	Optimization Techniques in Civil Engineering	PEC-I	3	0	0	40	60	3
	2001505	Advanced Structural Analysis							
	2001506	Remote Sensing & GIS							
5	**Open Elective-1**								
	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: **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: **Electronics and Communication Engineering**								
	20OE401	Overview of Microcontrollers	OEC-1	3	0	0	40	60	3
	20OE402	Industrial electronics	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	20995M2	Organizational behaviour	MC	2	0	0	40	00	0
7	2001507	Concrete Technology Lab	PCC	0	0	3	40	60	1.5
8	2001508	Structural Analysis and Design Lab (Staad Pro)	PCC	0	0	3	40	60	1.5
9	20015S3	SketchUp-3D modelling	SC	1	0	2	40	60	2
10	2001509	Community Service Project	PROJ	0	0	3	100	-	1.5
		Total		**18**	**00**	**11**	**460**	**480**	**21.5**

VI Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2001601	Environmental Engineering	PCC	3	0	0	40	60	3
2	2001602	Water Resources Engineering	PCC	3	0	0	40	60	3
3	2001603	Design of Reinforced Concrete Structures	PCC	3	0	0	40	60	3
		PEC-II							
4	2001604	Pre-stressed Concrete	PEC-II	3	0	0	40	60	3
	2001605	Bridge Engineering							
	2001606	Traffic Engineering							
5	Courses offered by: **HSSE**								
	2006601	Human Resource Development	HSSE	3	0	0	40	60	3
	2006602	Digital Marketing							
	2006603	Project Management							
6	20993M3	Constitution of India	MC	2	0	0	40	00	0
7	2001607	Environmental Engineering Lab	PCC	0	0	3	40	60	1.5
8	2001608	Computer Aided Design and Drafting Lab	PCC	0	0	3	40	60	1.5
9	2001609	Advanced Concrete Technology Lab	PCC	0	0	3	40	60	1.5
10	20016S4	Advanced English Communication skills lab	SC	1	0	2	40	60	2
		Total		**18**	**00**	**11**	**400**	**540**	**21.5**

VII Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
		PEC-III							
1	2001701	Ground Improvement Techniques	PEC-III	3	0	0	40	60	3
	2001702	Quantity Estimation of structures							
	2001703	Finite Element Methods							
		PEC-IV							
2	2001704	Design of Steel Structures	PEC-IV	3	0	0	40	60	3
	2001705	Water Supply Engineering							
	2001706	Advanced Concrete Structures							
		PEC-V							
3	2001707	Design and Drawing of Irrigation Structures	PEC-V	3	0	0	40	60	3
	2001708	Construction Practice and Management							
	2001709	Urban Transportation Planning							
4	**Open Elective-2**								
	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: **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: **Electronics and Communication Engineering**								
	20OE403	Introduction to VLSI	OEC-2	3	0	0	40	60	3
	20OE404	Principles of Communication	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: **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: **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: **Electronics and Communication Engineering**								
	20OE405	Electronic Instrumentation and measurements	OEC-3	3	0	0	40	60	3
	20OE406	Introduction to IOT	OEC-3	3	0	0	40	60	3
	20OE407	Nano Electronics	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: **Electrical and Electronics Engineering**								
	20OE207	Basics of 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: **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: **Electronics and Communication Engineering**								
	20OE408	Fundamentals of RADAR Engineering.	OEC-4	3	0	0	40	60	3
	20OE409	Biomedical Instrumentation	OEC-4	3	0	0	40	60	3
	20OE410	Digital Circuits	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	20015S5	Practices in Geo-Technical Engineering	SOC-V	1	0	2	40	60	2
8	2001710	Industrial/Research Internship	PR	0	0	6	100	-	3
		Total		**19**	**00**	**08**	**380**	**420**	**23**

VIII Semester

S.No	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2001801	Project Work/Internship	PROJ	-	-	-	40	60	12
		Total		**-**	**-**	**-**	**40**	**60**	**12**

B.Tech I SEM – CE (R20UG)

<table>
<tr><td>Course Title</td><td colspan="5">Linear Algebra & Calculus</td><td colspan="3">B.Tech CE 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">2021101</td><td rowspan="2">Basic Science (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="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">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.</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">Develop the use of matrix algebra techniques that is needed by engineers for practical applications.</td></tr>
<tr><td>CO 2</td><td colspan="8">Utilize mean value theorems to real life problems.</td></tr>
<tr><td>CO 3</td><td colspan="8">Classify the functions of several variables which is useful in optimization techniques.</td></tr>
<tr><td>CO 4</td><td colspan="8">Evaluate multiple integrals.</td></tr>
<tr><td>CO 5</td><td colspan="8">Define Beta and Gamma functions.</td></tr>
</table>

UNIT-I

Matrices: 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. Diagonalisation by orthogonal transformation.

UNIT-II

Mean Value Theorems: 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: Partial derivatives, total derivative, chain rule, change of variables, Jacobians, Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

UNIT-IV

Multiple Integrals: 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: 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, 9th edition-2013.
3. Introductory Linear Algebra with applications, Kolman, Bernard Hill, David R
4. Linear Algebra, Hoffman Kennethkunze Ray

Reference Books:

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

<table>
<tr><td>Course Title</td><td colspan="5">Engineering Physics</td><td colspan="3">B.Tech CE 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">20EP102</td><td rowspan="2">Basic Science (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="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

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, study of propagation of light wave through optical fibres along with engineering applications.
- To open new avenues of knowledge in magnetic materials which find potential in the emerging micro device applications? Considering the significance of micro miniaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterial, their properties and applications in modern emerging technologies are elicited.
- To familiarize the concepts of theoretical acoustics to practical use in engineering field. To explain the significance of ultrasound and its application in NDT for diversified engineering application.
- To enlighten the periodic arrangement of atoms in crystals, Bragg's law and to provide fundamentals related to structural analysis through powder diffraction method.

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

CO1	Understand the different realms of physics and their applications in both scientific and technological systems through physical optics.
CO2	Identify the wave properties of light and the interaction of energy with the matter.
CO3	Illustrate the response of magnetic materials to the applied electric and magnetic fields.
CO4	Explain the basic concepts of acoustics and ultrasonic.
CO5	Classify the important properties of crystals like the presence of long-range order, periodicity and structure determination using X-ray diffraction technique.

UNIT-I

Wave Optics: 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 of Optical 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 free electron 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. Krishnasagar, S.Chand and Company
2. Optics- Ajoy Ghatak , McGraw Hill Publishers,6th edition,1st January,2018.
3. Fundamental of Physics- Halliday, Resnick and Walker, Wiley publications.
4. Solid State physics, Hall H E, paramount Publications

Reference Books:

1. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers.
2. Acoustic Waves and Oscillations- Sen S N, Prism Publications.
3. Lasers & Non-linear Optics Nelkon M Parker P, Arnold Heinemann Publications
4. Solid State Physics-Kittels-8th edition,1st January-2015, Wiley Publications.

<table>
<tr><td>Course Title</td><td colspan="5">Communicative English</td><td colspan="3">B.Tech CE 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">2024103</td><td rowspan="2">Humanities and Social Sciences Management (HSMC)</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>
</table>

Course Objectives:

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- 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

CO1	Describe the classification of words, sentences and their usage in sentences.
CO2	Understand the difference between spoken and written English
CO3	Analyze the rules in language for changing the form of sentences
CO4	Illustrate the factors that influence grammar and vocabulary in speaking and writing
CO5	Classify the parts of speech, tenses and sentence structures.

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 context clues; 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: Writing structured essays on specific topics using suitable claims and evidences.

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

Text Books:

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. Heinley ELT; 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 a Superior Vocabulary (2014)

7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler

Web links:

www.englishclub.com

www.easyworldofenglish.com

www.languageguide.org/english

<table>
<tr><td>Course Title</td><td colspan="4">Basic Electrical & Electronics Engineering</td><td colspan="3">B.Tech CE 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">2014104</td><td rowspan="2">Engineering Science (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>60</td><td>40</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 objective of the course is to learn basics of DC and AC circuits, Electrical Machines, Transformers and Power Systems. Theory, construction, and operation of electronic devices, biasing of BJTs and FETs, design and construction of amplifiers, concepts & principles of logic devices.</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">Understand the basic fundamentals of DC & AC circuits, network reduction techniques, machines and power system fundamentals</td></tr>
<tr><td>CO2</td><td colspan="8">Understand theory, construction, and operation of electronic devices, working of diodes and its applications, working of transistors, microcontrollers & their applications.</td></tr>
<tr><td>CO3</td><td colspan="8">Determine the currents, voltages using mesh and nodal analysis, Average and RMS values for different waveforms, equivalent circuit parameters using OC & SC test of single phase transformer.</td></tr>
<tr><td>CO4</td><td colspan="8">Obtain the EMF equation and characteristics of dc machines and Induction motor</td></tr>
<tr><td>CO5</td><td colspan="8">Analyze small signal amplifier circuits to find the amplifier parameters. Design small signal amplifiers using proper biasing circuits to fix up proper Q point</td></tr>
</table>

Part A: Basic Electrical Engineering

UNIT-I

DC Circuits: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem. Simple Numerical Problems.

AC Circuits: Representation of sinusoidal waveforms – Average and RMS values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single- phase ac circuits consisting of RL - RC - RLC series circuits, simple numerical problems.

UNIT – II

DC Machines: Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Torque equation –

Performance Characteristics of DC Motor, speed control (Flux & Armature control of shunt motor), Simple numerical problems.

Transformers: Principle and operation of Single Phase Transformer – Emf equation, equivalent circuit, OC and SC tests on transformer, simple numerical problems.

Induction Motor: Principle and operation of 3-phase Induction Motor [Elementary treatment only].

UNIT – III

Basics of Power Systems: Typical AC power supply scheme – Generation of 3-phase supply, Definition of short, medium and long transmission lines – Concepts of AC & DC distribution system.

Text Books:

1. D. P. Kothari and I. J. Nagrath - “Basic Electrical Engineering” - Tata McGraw Hill - 2010.
2. V.K. Mehta & Rohit Mehta, “Principles of Power System” – S.Chand – 2018.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
4. 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. C.L. Wadhwa – “Generation Distribution and Utilization of Electrical Energy”, 3rd Edition, New Age International Publications.
4. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.

Part B: Basic Electronics Engineering

UNIT – I

Diodes and Applications: Semiconductor Diode, Diode as a Switch& Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications of Zener Diode, LED, Photo Diode.

Transistor Characteristics: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Biasing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

UNIT – II

Operational Amplifiers and Applications: Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

UNIT – III

Digital Electronics: Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder. Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters. Introduction to Microcontrollers and their applications (Block diagram approach only).

Text Books:

1. R.L.Boylestad& Louis Nashlesky, Electronic Devices &Circuit Theory, Pearson Education, 2007.
2. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, 4thEdition, Pearson, 2017.
3. R. P. Jain, Modern Digital Electronics,3rd Edition, Tata Mcgraw Hill,2003.
4. David A. Bell, “Electronic Devices and Circuits”, Oxford; Fifth edition.

Reference Books:

1. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.

2. Jimmie J Cathey, "Electronic Devices and Circuits," Schaum"s outlines series, 3rd edition, McGraw-Hill (India), 2010.

3. R. S. Sedha, A Text Book of Electronic Devices and Circuits, S. Chand & Co, 2010.

4. Anil K. Maini, Varsha Agrawal, "Electronic Devices and Circuits", John Wiely, 2nd edition.

<table>
<tr><td>Course Title</td><td colspan="4">Engineering Drawing</td><td colspan="3">B.Tech CE 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">Engineering Science (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="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</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 its Significance-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 to orthographic projections - simple objects.

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

UNIT – V

Perspective projection –applications of perspective view –terminology of perspective 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.
3. Interpreting Engineering DrawingsBook by Ted Branoff.
4. Mechanical Drawing: Board & CAD TechniquesBook by Jay D. Helsel.

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

<table>
<tr><td>Course Title</td><td colspan="5">Engineering Drawing Lab</td><td colspan="3">B.Tech CE 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">Engineering Science (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">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</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>

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, poly lines, trimming, extending, stretching, fillets, arrays, dimensions.

Dimensioning principles and conventional representations.

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

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

Text Books:

1. K. Venugopal, V. Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.
3. Mechanical Drawing: Board & CAD TechniquesBook by Jay D. Helsel.

4. A Textbook of Engineering Drawing: For Undergraduate ...Book by Addisu Dagne Zegeye

Reference Books:

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

Course Title	Engineering Physics Lab					B.Tech CE I Sem (R20)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20EP107	**Engineering Science (BSC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		0	**0**	**3**	**1.5**	**40**	**60**	**100**
Mid Exam Duration: ---						**End Exam Duration: 3 Hrs**		

Course Objectives:

- Understand the role of Optical fiber parameters in engineering applications
- Identify the generation of magnetic field through current carrying conductor.
- Apply the concepts of interference and diffraction.
- Illustrates the magnetic materials applications.
- Recognize the significance of laser by studying its characteristics and its application in finding the particle size.

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

CO 1	Operate various optical and electronic instruments.
CO 2	Apply the concepts of interference and diffraction to determine various parameters
CO 3	Estimate wavelength of laser and particles size using laser.
CO 4	Evaluate the acceptance angle of an optical fiber and numerical aperture.
CO 5	Plots the intensity of the magnetic field of circular coil carrying current with distance

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

List of Experiments:

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

Experimental outcomes:

Operates optical instrument like travelling microscope.

Estimate the thickness of the wire using wedge shape method.

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

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

Experimental outcomes:

Operates optical instrument like travelling microscope.

Estimate the radius of curvature of the lens.

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

Plots the square of the diameter of a ring with no. of rings.

3. Determination of wavelength by plane diffraction grating method

Experimental outcomes:

Operates optical instrument like spectrometer.

Estimate the wavelength of the given source.

Identifies the formation of grating spectrum due diffraction.

4. Determination of dispersive power of prism.

Experimental outcomes:

Operates optical instrument like spectrometer.

Estimate the refractive index and dispersive power of the given prism.

Identifies the formation of spectrum due to dispersion.

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

Experimental outcomes:

Operates various instrument.

Estimate the wavelength of laser source.

Identifies the formation of grating spectrum due diffraction.

6. Determination of particle size using LASER.

Experimental outcomes:

Operates various instrument.

Estimate the Particles size using laser.

Identifies the application of laser.

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.

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

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

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

Experimental outcomes:

Operates various instruments and connect them as per the circuit.

Estimate the dielectric constant of the given substance.

Identifies the significance of dielectric constant in various devices.

9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.

Experimental outcomes:

Operates various instruments and connect them as per the circuit.

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

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

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.

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

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

Plots the magnetic field H and flux density B.

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

Experimental outcomes:

Operates various instruments and connect them as per the circuit.

Estimate the resistivity of a semiconductor.

Identifies the importance of four probe method in finding the resistivity of semiconductor.

12. To determine the energy gap of a semiconductor

Experimental outcomes:

Operates various instruments and connect them as per the circuit.

Estimate the energy gap of a semiconductor.

Illustrates the engineering applications of energy gap.

Plots 1/T with log R.

Text books:

1. S.Balasubramanian, M.N.Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

2. Physics Laboratory Manual by Loyd D H, Cengage learning, 4Th International Edition 2014.

3. Et.Al. Engineering Physics Lab Manual by Madhusudhana Rao, SCITECH PUBLICATIONS (INDIA) PVT. LTD, 2015.
4. Practical Physics by K. Venugopalan (Author), Vimal Saraswat (Author), Himanshu Publications (1 January 2018)

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Reference Books:

1. Physics Laboratory Experiments, by Jerry Wilson (Author), Cecilia A. Hernandez Hall (Author), Brooks/cole; 7th edition (11 June 2009)

2. Lab manual Physics, R Rangarajan, R P Manchanda, R K Gupta, Rajesh Kumar Neena Sinha- New Saraswati House

3. Practical Physics by Kumar P. R. Sasi, Prentice-Hall of India Pvt.Ltd

Weblink:

1. http://vlab.amrita.edu/index.php - Virtual Labs, Amrita University.

<table>
<tr><td>Course Title</td><td colspan="5">Communicative English Lab</td><td colspan="3">B.Tech CE 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">2024108</td><td rowspan="2">Humanities and Social Sciences Management (HSMC)</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">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

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.

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

CO 1	Describe objects, places and persons
CO 2	Understand the listening process and answer the questions related to it.
CO 3	Analyze phonetics with examples
CO 4	Illustrate different modes of communication skills
CO 5	Classify LSRW Skills

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. Heinley ELT; 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="4">Basic Electrical & Electronics Engineering Lab</td><td colspan="3">B.Tech CE 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">2014109</td><td rowspan="2">Basic Science (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="6">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
The objective of the course is to verify KCL, KVL, superposition theorem, measurement of real & reactive power for RL & RC circuits, performance characteristics of DC machines and transformers. Analyze the characteristics of Diodes, BJT, MOSFET, UJT, design the amplifier circuits from the given specifications and verification of truth tables.</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	Verify Kirchhoff's laws, superposition theorem theoretically and practically for any given circuit, truth table for different logic gates and measure real & reactive power for RL & RC circuits
CO 2	Illustrate various characteristics of DC machines from the measured data (Practically)
CO 3	Obtain the efficiency and regulation for single phase transformer
CO 4	Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT
CO 5	Analyze the application of diode as rectifiers, clippers and clampers and other circuits

Part– A

Basic Electrical Engineering Lab (Any 5 experiments)

List of experiments

1. Verification of Kirchhoff laws
2. Verification of Superposition Theorem
3. Magnetization characteristics of a DC Shunt Generator
4. Speed control of DC Shunt Motor
5. OC & SC test of 1 – Phase Transformer
6. Load test on 1-Phase Transformer
7. Brake test on DC Shunt Motor
8. Measurement of Real & Reactive Power by single phase RL, RC circuits

Part – B

Basic Electronics Engineering Lab (Any 5 experiments)

List of Experiments

1. PN Junction diode characteristics A) Forward bias B) Reverse bias
2. Zener diode characteristics and Zener as voltage Regulator
3. Full Wave Rectifier with & without filter
4. Wave Shaping Circuits. (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration.
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting amplifiers using Op-AMPs.
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
9. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

B.Tech II SEM – CE (R20UG)

<table>
<tr><td>Course Title</td><td colspan="4">Differential Equations and Vector Calculus</td><td colspan="3">B.Tech CE 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">2021201</td><td rowspan="2">Basic Science (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="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 enlighten the learners in the concept of differential equations.
• 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</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">Classify second and higher order liner D.E's with constant coefficients.</td></tr>
<tr><td>CO 2</td><td colspan="8">Solve partial differential equations.</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze the applications of partial differential equations.</td></tr>
<tr><td>CO 4</td><td colspan="8">Understand vector differentiation concepts.</td></tr>
<tr><td>CO 5</td><td colspan="8">Apply vector integration concepts.</td></tr>
</table>

UNIT-I

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

UNIT-II

Partial Differential Equations: 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: 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: 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: 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 edition 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9^{th} edition- 2013
3. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, Pearson, 9^{th} Edition, Reprint, 2002.
4. Advanced Engineering Mathematics, Greenberg Michael D, Cengage Publishers.

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. Applied Calculus, Hegarty John C
4. Advanced Calculus, Widder V David, Pearson Publishers.

<table>
<tr><td>Course Title</td><td colspan="5">Engineering Chemistry</td><td colspan="3">B.Tech CE 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">20EC202</td><td rowspan="2">Basic Science (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="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 familiarize engineering chemistry and its applications
• To impart the concept of soft and hard waters, softening methods of hard water
• To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement.</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">Evaluate the amount of hardness and dissolved oxygen present in water sample.</td></tr>
<tr><td>CO 2</td><td colspan="8">Demonstrate the corrosion prevention methods and factors affecting corrosion.</td></tr>
<tr><td>CO 3</td><td colspan="8">Explain the preparation, properties, and applications of thermoplastics & thermosetting, Elastomers & conducting polymers</td></tr>
<tr><td>CO 4</td><td colspan="8">Understand the setting and hardening of cement and concrete phase.</td></tr>
<tr><td>CO 5</td><td colspan="8">Analyze the concepts of colloids, micelle and nanomaterials.</td></tr>
</table>

UNIT-I

Water Technology: Introduction –Soft Water and hardness of water, hardness of water by EDTA Method, Estimation of dissolved oxygen (Winkler's method)-Boiler troubles –Priming, foaming**,** scale and sludge, Caustic embrittlment, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.

UNIT-II

Electrochemistry and Applications: Introduction to electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

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.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bed worth ratios and uses, Factors affecting the corrosion, Cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

UNIT-III

Polymers and Fuel Chemistry: Introduction to polymers, Polymer dispersion index, functionality of monomers, Mechanism of chain growth, step growth and coordination polymerization.

Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC and Bakelite

Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol

Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, Liquid Fuels refining of petroleum, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane values, cracking of oils; alternative fuels-propane, methanol and ethanol, bio-fuels.

UNIT-IV

Advanced Engineering Materials: Refractories- Classification, Properties, Factors affecting the refractory materials and Applications.

Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point.

Building materials- Portland cement, constituents, phases and reactivity of clinker, Setting and Hardening of cement.

UNIT-V

Surface Chemistry and Applications: Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (Dispersion method), chemical and electrochemical method (chemical vapour deposition) of preparation of nano metals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, applications of colloids and nanomaterials –medicine.

Text Books:

1. A textbook of Engineering chemistry by Shashi Chawla, Dhanpat Rai & Co publications
2. Text Book of Physical Chemistry, Samuel Glasstone, Mcmillian publications.
3. Textbook of Polymer Science, Third Edition, Fred W. Billi Meyer, TR, A Wiley-Inter Science Publications.
4. An Introduction to Electrochemistry, Glasstone, Arihant Publications.

Reference Books:

1. Textbook of Engineering Chemistry, Jain and Jain, DhanpatRai& Co publications, 2013
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman,1992.
3. Water Technology, 2nd Edition, N.F. Gray, Elsevier publications, 2005.
4. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.

<table>
<tr><td>Course Title</td><td colspan="4">C Programming & Data Structures</td><td colspan="3">B.Tech CE 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">Engineering Science (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: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The course aims to provide exposure to problem-solving through programming and 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>
</table>

CO 1	Formulate simple algorithms for arithmetic and logical problems and to translate the algorithms to programs (in C Language)
CO 2	Choose the loops and decision-making statements to solve the problem.
CO 3	Implement different Operations on arrays.
CO 4	Use functions to solve the given problem and Understand structures, unions and pointers.
CO 5	Understand need of data structures in real time situations.

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: types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern. Strings: string handling functions, and Command line arguments.

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 of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, and postfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

Searching and sorting: linear search, binary search, bubble (exchange) 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, Prentice Hall of India
2. R.G. Dromey, How to solve it by Computer,Pearson.
3. YashavantKanetkar, Let us C, 15th edition, BPBPublications.
4. Dr. P. ChennaReddy, Computer Fundamentals and C Programming, SecondEdition

<table>
<tr><th>Course Title</th><th colspan="5">Strength of Materials</th><th colspan="3">B.Tech CE 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">2001204</td><td rowspan="2">Engineering Science (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: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- To make the students understand the effect of forces on rigid body & to calculate CG and moment of inertia of solids and surfaces.
- To make students learn the basic concepts of strength of materials, elastic moduli and their relations and temperature stresses.
- To impart procedure for drawing shear force and bending moment diagrams for determinate beams.
- To make the student able to analyze flexural stresses in various sections due to different loads.
- To make the student able to analyze shear stresses in various sections due to different loads and analyze determinate trusses.

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

CO 1	Understand the different types of forces systems and its effect on rigid bodies and to locate CG and moment of inertia of different geometrical shapes
CO 2	Understand the concepts of stress, strain, elastic moduli, stresses in composite bars and temperature stresses.
CO 3	Develop shear force and bending moment diagrams of determinate beams for different loads.
CO 4	Compute the flexural stresses of different cross-sections under different loads.
CO 5	Compute and visualize the shear stresses variation across depth of sections under different loads.

UNIT-I

Introduction to Mechanics: Basic Concepts, system of Forces -Coplanar Concurrent Forces - Components in Space Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial systems- **Center of Gravity, Centroid and moment of inertia:** Introduction – Center of gravity/centroid and Moment of Inertia of rectangular, circular, Triangular, I, L and T sections - built up sections.

UNIT – II

Simple Stresses and Strains: Types of stresses and strains – Hooke‘s law – Stress – strain diagram for mild steel – working stress – Factor of safety – lateral strain, Poisson‘s ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of Varying section – Composite bars – Temperature stresses. Strain energy – Resilience – Gradual, Sudden, impact and shock loadings – simple applications.

UNIT – III

Shear Force and Bending Moment: Definition of beam – types of beams – types of supports – types of loads - Concept of Shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and over changing beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads – point of contra flexure – Relation between S.F, B.M and rate of loading at a section of a beam.

UNIT – IV

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/Y = E/R – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hallow), I, T, Angle and Channel Sections – Design of simple beam sections.

UNIT – V

Shear Stresses: Derivation of Formula-Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections. Combined bending and shear.

Analysis of trusses by Method of Joints & Sections.

Text Books:

1. S. Timoshenko, D.H. Young and J.V. Rao, “Engineering Mechanics”, Tata McGraw-Hill Company.

2. E.P. Popov, “Mechanics of Materials”, Hardcover, Prentice-Hall, 1958.
3. R.K. Rajput, “Strength of Materials”, S.Chand Publishers.
4. R. K. Bansal, “Strength of Materials”, Lakshmi Publications House Pvt. Ltd.

Reference Books:

1. S.S. Bhavikatti, “Strength of materials”, Vikas publishing house Pvt. Ltd.
2. R. Subramanian, “Strength of Materials”, Oxford University Press.
3. F. L. Singer and A. Pytel, “Strength of materials”, 4th edition, Longman, 1990
4. Stephen P. Timoshenko, History of Strength of Materials (Dover Civil and Mechanical Engineering), Dover Publications Inc.

Course Title	Engineering Workshop					B.Tech CE II Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20EW205	Laboratory (LC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	40	60	100
Mid Exam Duration: ---						End Exam Duration: 3 Hrs		

Course Objectives: To familiarize students with

- Sheet metal operations
- Fitting
- Electrical house wiring skills
- Wood working

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

CO 1	Apply wood working skills in real world applications
CO 2	Build different objects with metal sheets in real world applications
CO 3	Apply fitting operations in various applications.
CO 4	Apply different types of basic electric circuit connections
CO 5	Use soldering and brazing techniques.

Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints

Half – Lap joint

Mortise and Tenon 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><td>Course Title</td><td colspan="4">IT Workshop</td><td colspan="3">B.Tech CE 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">2005206</td><td rowspan="2">Laboratory (LC)</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>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">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</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.

<u>Networking and Internet:</u>

Task 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 tools:

Task 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 a user manual of the word processor considered.

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).

Reference Books:

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.

<table>
<tr><th>Course Title</th><th colspan="4">Engineering Chemistry Lab</th><th colspan="3">B.Tech CE 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">20EC207</td><td rowspan="2">Basic Science (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="6">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To verify the fundamental concepts with experiments.
• The student will have exposure to various experimental skills and hand-on experience which is very essential for an Engineering student.</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">Determine the cell constant and conductance of solutions by using conductometer & pH meter.</td></tr>
<tr><td>CO 2</td><td colspan="8">Synthesis of advanced polymer materials.</td></tr>
<tr><td>CO 3</td><td colspan="8">Compare the physical properties like adsorption and viscosity.</td></tr>
<tr><td>CO 4</td><td colspan="8">Evaluate the Iron and Calcium in cement.</td></tr>
<tr><td>CO 5</td><td colspan="8">Estimate the hardness & dissolved oxygen content in water.</td></tr>
</table>

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

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. Estimation of dissolved oxygen by Winkler's method
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 a polymer (Bakelite).
9. Determination of percentage of Iron in Cement sample by colorimetry
10. Estimation of Calcium in port land Cement
11. Preparation of nanomaterials by precipitation.
12. Adsorption of acetic acid by charcoal
13. Determination of percentage Moisture content in a coal sample
14. Determination of Viscosity of lubricating oil by Redwood Viscometer 1.

15. Determination of Viscosity of lubricating oil by Redwood Viscometer 2.

Text Books:

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et.al., Pearson Education, Sixth Edition, 2012.
2. Laboratory manual on Engineering Chemistry, Anupama Rajput, Dhanpat Rai& Co Publications.
3. Essentials of Experimental Engineering Chemistry, Shashi Chawla, Dhanpat Rai& Co Publications.

Reference Books:

1. Practical Engineering Chemistry by K. Mukkanti, etal, B.S. Publications, Hyderabad.
2. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.
3. Essentials of Physical Chemistry, Bhal & Tuli. (S. Chand Publications).
4. Advanced Inorganic Analysis, Agarwal & Keemtilal (Pragati prakashan)

<table>
<tr><td>Course Title</td><td colspan="5">C Programming & Data Structures Lab</td><td colspan="3">B.Tech CE 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">2005208</td><td rowspan="2">Engineering Science (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">Mid Exam Duration:---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To know how to write and debug programs.
• To know the principles of designing structured programs
• To Write basic C programs using, Selection statements, Repetitive statements
• To understand Functions, Pointers, Arrays, Strings and structures
• To apply suitable data structure to solve real world problems</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	Formulate the algorithms for simple problems, Translate given algorithms to a working and correct program.
CO 2	Correct syntax errors as reported by the compilers, Identify and correct logical errors encountered at runtime.
CO 3	Write iterative as well as recursive programs.
CO 4	Represent data in arrays, strings and structures and manipulate them through a program.
CO 5	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 gross salary.

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 a Quadratic equation ($ax^2+bx+c=0$) 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 appropriate messages.

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

6. A character is entered through keyboard. Write a C program to determine whether the 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 a value 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 given array.

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

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 space sand 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 following members.

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 single linked list.

i) Creation

ii) Insertion

iii) Deletion

iv) Traversal

29. Write a C program that uses functions to perform the following operations on Double linked 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.

Text Books:

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.

<table>
<tr><td>Course Title</td><td colspan="4">Strength of Materials Lab</td><td colspan="3">B.Tech CE 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">2001209</td><td rowspan="2">Engineering Science (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">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- To enhance the knowledge of students on stress at a point under tension, compression and shear.
- To enable students, understand the energy absorption capacity of the springs.
- To enable student to assess hardness of various metals.
- To enable students, distinguish between sagging and hogging deflections of different beams under loading conditions.
- To give light on basic mechanical properties of materials used in engineering practice.

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

CO 1	Visualize the stress-strain relationships for MS bas/HYSD bar
CO 2	Analyse the compressive and shear strength properties of wood/concrete and metal
CO 3	Determine the stiffness of the spring and bar element
CO 4	Deflection of various metallic beams under point load condition(s)
CO 5	Compute Hardness Number and impact strength of different metals

List of Experiments

1. Tension test on HYSD bar.
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on a simply supported beam.
4. Torsion test on mild steel specimen.
5. Hardness test on metals.
6. Compression test on Open coiled springs
7. Tension test on Closely coiled springs
8. Compression test on wood/concrete
9. Izod / Charpy Impact test on a mild steel specimen
10. Shear test on a mild steel specimen

List of Augmented Experiments:

1. Continuous beam–deflection test.
2. Verification of Maxwell’s reciprocal theorem.

Reference Books:

1. R.K. Rajput, “Strength of Materials”, S. Chand Publishers.
2. R. Subrahmanyam , “Strength of materials”, Oxford university press

<table>
<tr><td>Course Title</td><td colspan="5">Environmental Science</td><td colspan="3">B.Tech CE 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">Mandatory (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>--</td></tr>
<tr><td colspan="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: ---</td></tr>
</table>

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.

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

CO 1	**Explain** multidisciplinary nature of environmental studies and various Renewable and Nonrenewable resources.
CO 2	**Understand** the Energy flow, bio-geo chemical cycles and ecological pyramids
CO 3	**Illustrate** various causes of pollution and related preventive measures.
CO 4	**Summarize** Solid waste management, Social issues related to environment and their protection acts.
CO 5	**Evaluate** Causes of population explosion, value education and welfare programmes.

<u>UNIT – I</u>

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.

<u>UNIT – II</u>

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. Fundamental Concepts of Environmental Chemistry- Sodhi G S – Oxford University
3. Environmental Chemistry- Anil Kumar De-Willey Publications
4. Environment Impact Assessment- Larry W. Canter- Mc Graw Hill publications

Reference Books:

1. G. R. Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
2. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.
3. Environmental Science, A Global Concerns, William P. Cunningham, Mary Ann Cunningham, Mc Graw Hill publications.
4. Environmental Science & Engineering, Glynn Henry J, Heinke Gary w, Pearson publications.

B.Tech III SEM - CE (R20UG)

Course Title	Probability, Statistics & Numerical Methods					B.Tech CE III Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2021302	Basic Science (BSC)	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 familiarize the students' knowledge in basic concepts and few techniques in probability and statistics in relation to the engineering applications.
- Also, to impart with numerical methods of solving the non-linear equations and interpolation.

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

CO 1	Apply discrete and continuous probability distributions.
CO 2	Infer the statistical inferential methods based on large sampling tests.
CO 3	Infer the statistical inferential methods based on small sampling tests.
CO 4	Determine the roots of polynomial and transcendental equations by different methods.
CO 5	Estimate an unknown quantity by using related known values.

UNIT-I

Probability: Explaining basic concepts of Random variables (Without Problems)

Probability distributions: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties.

UNIT-II

Testing of Hypothesis: Formulation of null hypothesis, critical regions, level of significance. Large sample tests. Tests based on normal distribution –z -test for means and proportions.

UNIT-III

Small Sample Tests: t-test for one sample, two samples problem and paired t-test, F-test - Chi-square test (testing of goodness of fit and independence).

UNIT-IV

Solution of algebraic and transcendental equations: Bisection method – False - position method – Newton - Raphson method.

Solution of System of equations: Jacobi's iteration method – Gauss- Seidel iteration method.

UNIT-V

Interpolation: Finite differences - Forward differences - Backward differences - Newton's forward and backward difference formulae for interpolation - Lagrange's formula for unequal intervals- Inverse interpolation.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, 44/e, Khanna Publishers, 2017.
2. Probability & Statistics for Engineers & Scientists, Walpole, Myers, Myers, Ye, Seventh Edition, Pearson Education Asia.
3. Applied Numerical Analysis, Curtis F.Gerald, Patrick O.Wheatley, Seventh Edition, Pearson Education.
4. Numerical Methods, P. Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand & Company, 2/e, Reprint 2012.

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9th edition- 2013.
2. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal,Laxmi Publications, Reprint, 2010.
3. Numerical Methods, S Arumugam, A.Thangapandi Issac, A Somasundaram SCITECH Publishers, Second edition Reprint 2013.
4. Probability and Statistics for Engineers, Johnson, Fifth edition, Prentice Hall of India.

Course Title	Geology and Building materials					B.Tech CE III Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2001302	Engineering Science (ESC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	1	3.5	40	60	100
Mid Exam Duration: 1.5 Hrs						End Exam Duration: 3 Hrs		

Course Objectives:

- To give the basics knowledge of Geology that is required for constructing various Civil Engineering Structures, basic Geology.
- The ability to know the weathering procedure of rocks.
- The ability to understand Engineering properties of Rocks and their Minerals.
- To study the Engineering Properties of Building materials.
- To study the modern Engineering materials used in construction.

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

CO 1	Understand the geological structures and weathering of Rocks.
CO 2	Classify the minerals and summarise the engineering properties of Rocks.
CO 3	Study the various physical and engineering properties of basic materials used for construction.
CO 4	Understand the uses and practical application of roofing and Flooring materials.
CO 5	Know the various modern building materials and its applications in Civil Engineering domain.

UNIT – I

Introduction: Branches of Geology, Importance of Geology in Civil Engineering with case studies. **Structural Geology:** Strike, Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism, and their importance in Civil Engineering. **Weathering:** Weathering of rocks, Geological agents, weathering process of Rock, Rivers, and geological work of rivers.

UNIT-II

Mineralogy: Definition of mineral; Significance of different physical properties of minerals. Study of Common rock forming minerals and their identification; Clay minerals, Study of common economic minerals –Hematite, Magnetite, Galena. Graphite, Bauxite, Coal.

Petrology: Definition of rock: Geological classification of rocks.Study of different group of minerals, physical properties and their identification.

Engineering Properties of Rocks: Different Engineering properties of rocks. Study of common Rocks – Granite - Basalt – Dolerite – Pegmatite – Sandstone – Limestone – Shale – Laterite - Granite gneiss – schist – Marble - quartzite – khondalite – Charnockite.Study of identification of rocks (Igneous, sedimentary and metamorphic rocks) and structural geology problems. Study of topographical features from geological maps.

UNIT – III

Introduction: Physical, chemical, and engineering properties of building materials. Application of building materials. **Bricks:** Types of bricks, manufacturing process of bricks, Test on bricks, Standard requirements, and grades of bricks as per BIS. **Cement:** Types of cement with their specific use, Grade of cement as per BIS, Engineering properties of cement, Field, and laboratory test of cement as per BIS, Methods of storing the cement. **Lime and pozzolan:** Sources and classification of Lime, Uses of lime with specific field situation, Types of pozzolanic materials, Advantages of addition of pozzolanic material. **Timber:** Types of timber, Uses and application of timber, Defects in timber and wood, Seasoning, Wood products with specific uses.

UNIT – IV

Roofing Material: Structural Steel and Aluminium – Roofing Material - Physical description of asbestos sheets, GI sheets, tubes, and light weight roofing materials.

Flooring Materials: Functional requirement of flooring, types of floor finishes, Types of flooring: timber flooring, cement concrete flooring, mosaic flooring, ceramic flooring, terrazzo flooring, tiled flooring, rubber flooring, epoxy asphalt flooring. Industrial flooring: Vacuum Dewatered Flooring – Bitumen – forms of bitumen - functions of bituminous materials – Tests for bituminous materials.

UNIT – V

Modern Building Materials: Fibre glass reinforced plastic – Clay products –Refractories – Composite materials – Types – Applications of laminar composites – Fibre Textiles – Geosynthetics for Civil Engineering applications -Recycling of Industrial waste as building material - Polymers in Civil Engineering.

Text Books:

1. Engineering Geology by N. Chennakesavulu, Laxmi publications, 2nd Edition, 2016.
2. Engineering Geology by D. Venkat Reddy, Vikas Publishing House Pvt. Ltd., 2017.
3. Parbin Singh, Engineering and General Geology, Katson Publication House, 1987.
4. Krynine and Judd, Engineering Geology and Geotechniques, McGraw Hill Book Company,New Delhi, 1990.

Reference Books:

1. F.G. Bell, Fundamentals of Engineering Geology, Butterworth-Heinemann, Kindle Edition, 2016.
2. Legeet, Geology and Engineering, McGraw Hill Book Company, New Delhi 1998.
3. Bangar, K.M., Principles of Engineering Geology, Standard Publishers & Distributors,
   New Delhi, 2nd Edition, 2007.
4. Engineering Geology for Civil Engineers – P.C. Varghese PHI, 2012.

<table>
<tr><td>Course Title</td><td colspan="5">Advanced Strength of Materials</td><td colspan="3">B.Tech CE 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">2001303</td><td rowspan="2">Professional Core
(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>0</td><td>1</td><td>4</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:

Objective of this course is to make the students

- To understand calculation of deflection of beams under different loading conditions
- To understand the basic torsion concepts behind the shafts design and engineering knowledge behind the springs.
- To understand the stress at a point due to uniaxial and by-axial loading on a member and theory of failures from energy theories.
- To understand the fundamentals of Euler's theorem for columns and critical load carrying capacity of columns.
- To understand stresses in closed cylinders and design of thin and thick cylinders.

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

CO 1	Use double integration and Macaulay's methods to calculate deflection of beams.
CO 2	Apply torsion theory for design of shafts and springs.
CO 3	Estimate the principal stresses and principal strains in a body.
CO 4	Calculate load carrying capacity of short columns and long columns using Euler's and Rankin's theorem.
CO 5	Find the stresses and strains in thin cylinders and application of Lame's theorem for thick cylinders.

<u>UNIT – I</u>

Deflection of Beams: Slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L,uniformly varying load and couple -Mohr's theorems – Moment area method – Application to simple cases.

UNIT – II

Torsion: Theory of pure torsion, Torsional equation, Torsional moment of resistance, Polar section modulus, Power transmitted by shafts; combined bending, torsion and end thrust; Design of shafts.

Springs: Deflection of close and open coiled helical springs under axial load and axial twist, Springs in series and parallel.

UNIT – III

Principal Stresses and Strains: Stresses on an inclined plane under axial loading, Compound stresses, Normal and tangential stresses on an inclined plane for biaxial stresses, two perpendicular normal stresses accompanied by a state of simple shear, Mohr's circle of stresses, Triaxial state of stresses, Principal stresses and strains.

Theories of Failure: Maximum principal stress theory, Maximum principal strain theory, Maximum shear stress theory, Maximum strain energy theory, Maximum shear strain energy theory.

UNIT – IV

Columns and Struts: Short, medium and long columns, axially loaded compression members, Euler's theorem for long columns, Euler's critical load, Equivalent length of a column, Slenderness ratio, Limitations of Euler's theory, Rankine–Gordon formula, long columns subjected to eccentric loading.

UNIT-V

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter and volume of thin cylinders – thin spherical shells.

Thick Cylinders: Introduction - Lame's theory for thick cylinders – Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage.

Text Books:

1. Punmia, B. C., Ashok Kumar Jain and Arun Kumar Jain, Mechanics of Materials, Laxmi Publications Pvt. Ltd., 2001.
2. Bhavikatti, S. S., Strength of Materials, Vikas Publishing House, 3rd Edition, 2010.
3. Strength of Materials by R. Subramanian, Oxford University Press
4. Strength of Materials by B.S.Basavarajaiah and P. Mahadevappa, 3rd Edition, Universities Press

Reference Books:

1. Rajput, R. K., Strength of Materials (Mechanics of Solids), S. Chand & Company LTD, 5th Edition, 2006.
2. Basu, A. R., Strength of Materials, Dhanpat Rai & Co. (P) Ltd., 2nd Revised Edition, 2015.
3. Junnarkar, S. B. and Shah, H. J., Mechanics of Structures – Vol. I (Strength of Materials), Charotar Publishing House Pvt. Ltd., 27th Revised and Enlarged Edition, 2008.
4. Khurmi, R. S., Strength of Materials, S. Chand & Company Ltd., 23rd Edition, 2005.

Course Title	Fluid Mechanics					B.Tech CE III Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2001304	Professional Core (PCC)	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 develop a basic understanding about the properties of fluids and the applications of fluid mechanics.
- To formulate and analyse the problems related to calculation of forces in fluid structure interaction.
- To understand the concept of fluid measurement, types of flows.
- To enable the students to apply the basic principles of fluid mechanics on pipe flow network.
- To demonstrate the flow under laminar and turbulent, analyze the model studies of fluid flow problems.

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

CO 1	**Describe** the significance of fluid properties, **measure** the pressure and hydrostatic pressure and **analyze** forces on floating bodies.
CO 2	**Know** the basics of fluid kinematics, dynamics and **understand** and **apply** the Bernoulli principle.
CO 3	**Know** the applications of Bernoulli's equation in devices like venturimeter, orifice meter and flow through notches and weirs.
CO 4	**Categorize** fluid flow through pipes in series, parallel and pipe networks.
CO 5	**Analyze** the pipe network under laminar and turbulent and **demonstrate** model studies for fluid flow problems.

UNIT- I

Properties of Fluid: Distinction between a fluid and a solid, Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Fluid Statics: Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube manometer, single column manometer, U-Tube differential manometer, Micromanometers, pressure gauges. Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT – II

Fluid Kinematics: Classification of fluid flow - Steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one,two and three dimensional flows; stream line, path line, streak line and stream tube; stream function, velocity potential function. One,two and three dimensional continuity equations in Cartesian-oordinates.

Fluid Dynamics: Surface and body forces - Euler's and Bernoulli's equation; Energy correction factor; Momentum equation. Vortex flow – Free and Forced. Bernoulli's equation to real fluid flows.

UNIT – III

Flow Measurement in Pipes: Practical applications of Bernoulli's equation: venturi meter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend.

Flow Over Notches & Weirs: Flow through rectangular; triangular and trapezoidal notches and weirs; End contractions; Velocity of approach. Broad crested weir.

UNIT – IV

Analysis of pipe flow: Reynolds experiment, Reynolds number**,** loss of head through pipes, Darcy-Wiesbach equation, minor losses, total energy line, hydraulic grade line, pipes in series, equivalent pipes, pipes in parallel, siphon, branching of pipes, three reservoir problem, power transmission through pipes. Analysis of pipe networks: Hazen-Williams formula, Hardy Cross method, water hammer in pipes and control measures.

UNIT – V

Laminar Flow and Turbulent Flows: Reynold's experiment – Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydrodynamically smooth and rough flows.

Hydraulic Similitude: Dimensional analysis - Rayleigh's method and Buckingham's pi theorem - Model studies – Geometric, kinematic and dynamic similarities - Dimensionless numbers – Model laws – Scale effects.

Text Books:

1. Fluid Mechanics by Modi and Seth, Standard Book House, 20th edition 2018.
2. Fluid Mechanics and Hydraulic Machines by Manish Kumar Goyal, PHI learning
   Private Limited, 2015,Kindle edition 2015.
3. Fluid Mechanics by R.C.Hibbeler, Pearson India Education Services Pvt. Ltd, 2ndedition 2016.
4. Fluid Mechanics and Hydraulilc Machines, R.K. Bansal, Laxmi Publication Pvt Ltd.
   9th edition 2016.

Reference Books:

1. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill, 1993, First edition.
2. Introduction to Fluid Mechanics and Fluid Machines by S K Som, Gautam Biswas, Suman Chakraborthy, Mc Graw Hill Education (India) Pvt. Limited, 3rd Edition, 2016.
3. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010, First edition.
4. Fluid mechanics & Hydraulic Machines, Domkundwar&DomkundwarDhanpat Rai & Co, 9th edition 2015.

<table>
<tr><th>Course Title</th><th colspan="5">Geomatics</th><th colspan="3">B.Tech CE III 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">2001305</td><td rowspan="2">Professional Core (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>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>
</table>

Course Objectives:

- Improve the knowledge working principles of survey instruments.
- Perform field work for plane table and levels by levelling instrument for prepare maps with levels.
- Perform traverse calculations, horizontal and vertical positions and angles through Theodolite surveying and Tacheometric surveying.
- To evaluate areas and volumes of earth work and setting of curves.
- To describe the modern surveying tools are usage by EDM and drone 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	Understand the basics on linear and angular measurements with the help of Theodolite and Tacheometer.
CO 4	Compute areas and volumes of a field for different practical conditions and curve setting.
CO 5	Apply the modern surveying techniques for various field problems.

UNIT - I

Introduction: Introduction, Objectives, classification and principles of surveying.

Chain Surveying: Principles of Chain Surveying, Chaining, Type of chains, Recording the measurement, Offsets and their types, Number of offsets, Computation of areas, Errors in lengths due to incorrect chain, Correction for slopes, Error in chaining with tape and corrections, Numerical on chain and tape corrections

Compass Surveying: Types of compass, Bearings, Included angles, Errors and adjustments.

UNIT – II

Plane Table Surveying: Equipment, Methods of plane tabling, Errors, Two- and three-point problems.

Levelling and Contouring: Types of levelling, Types of levelling instruments, Temporary and permanent adjustments, Height of instrument and rise and fall methods, Plotting longitudinal sections and cross sections, Effect of curvature and refraction, Characteristics of contours, Uses of contour maps.

UNIT – III

Theodolite Surveying: Description of theodolite, Temporary and permanent adjustments of vernier transit, Measurement of horizontal and vertical angles, Heights and distances, Traversing, closing error and distribution, Gale's traverse table, omitted measurements.

Tacheometric Surveying: Principle of stadia method, Distance and elevation formulae for staff held vertical and normal, Instrumental constants, Analytic lens, Tangential method.

UNIT – IV

Computation of Areas: Areas dividing into number of triangles, By offsets to a base line, By coordinates, Areas from maps.

Computation of Volumes: Volume from cross-section, Embankments and cutting for a level section and two-level sections with and without transverse slopes, Determination of the capacity of reservoir.

Route surveying – Curves: Curves - Types - Elements of a curve - Simple curves - Setting out of curves using various methods – Geometry of compound curves and reverse curves – Introduction to transition and vertical curves.

UNIT – V

Electromagnetic distance measurement (EDM) – Principle of EDM, Modulation, Types of EDM instruments, Distomat.

Total Station – Parts of a Total Station – Accessories – Advantages and Applications, Introduction to Astronomical terms, Field Procedure for total station survey, Errors in Total Station Survey

Drone Surveying: Working principle, Benefits of drones in surveying, Applications, Interior and exterior drone surveying, Calculation of length, area and stockpile volume.

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, New Delhi, 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, 3rd Edition,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 Griha Prakashan, Pune, 24th Edition, 2013

<table>
<tr><td>Course Title</td><td colspan="4">Fluid Mechanics Laboratory</td><td colspan="3">B.Tech CE III Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="2">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2001306</td><td rowspan="2">Professional Core (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>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">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- To identify the behavior of analytical models introduced in lecture to the actual behavior of real fluid flows.
- To explain the standard measurement techniques of fluid mechanics and their applications.
- To illustrate the components and working principles of the hydraulic machines- different types of Turbines, Pumps, and other miscellaneous hydraulics machines.
- To analyze the laboratory measurements and to document the results in an appropriate format.
- To actively apply technical knowledge and skill for solving day to day civil engineering problems.

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

CO 1	Understand the fluid flow concepts and get familiarity with flow measuring devices
CO 2	Understand the sources of major and minor losses and its particle conditions.
CO 3	Illustrate the effect of change in pressure head, flow rate & coefficient of discharge of flow meters.
CO 4	Perform the experiment on the working and characteristics of hydraulic pumps
CO 5	Demonstrate practical understanding of the various equations of Bernoulli

<u>List of Experiments:</u>

1. Determination of coefficient discharge for Venturimeter.
2. Determination of coefficient discharge for Orifice meter.
3. Study of the Impact of Jet on vanes.
4. Determination of the Friction factor of a pipeline.
5. Losses in pipes due to contraction.
6. Study on performance characteristics of single-stage Centrifugal Pump.

7. Study on performance characteristics of multistage Centrifugal Pump.
8. Study on performance characteristics of Reciprocating Pump.
9. Study on performance characteristics of Pelton wheel turbine.
10. Verification of Bernoulli's Equation

Augmented experiments:

1. Calibration of contracted rectangular notch / triangular Notch
2. Performance characteristics of Kaplan turbine
3. Performance characteristics of Francis turbine

Reference Books/Laboratory Manuals:

Fluid mechanics and hydraulic machinery laboratory manual, Department of civil engineering, KSRMCE, Kadapa.

Course Title	Geomatics Laboratory					B.Tech CE III Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2001307	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	40	60	100
Mid Exam Duration: 1.5 Hrs						End Exam Duration: 3 Hrs		

Course Objectives:

By performing this laboratory, the student will be able

- to know the usage of various surveying equipment's and their practical applicability.
- To acquire practical knowledge on handling basic chain survey equipment's
- To have the ability to prepare plan and levels of ground surface by using Plane table survey and leveling instrument.
- To possess knowledge about the Theodolite Surveying and Tacheometric Surveying
- To have the ability to calculate area, volume and curve setting.
- To possess knowledge about the advanced surveying instruments and it's handling.

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

CO 1	Measurement of an area by chain survey obtain the direction of a surveying line with a prismatic and surveyors compass
CO 2	Survey the area using different methods of plane tabling and compass survey and to adjust the compass traverse graphically.
CO 3	Record the reduced levels using various methods of levelling and measurement of horizontal & vertical angles by Theodolite.
CO 4	Estimate areas, volumes of cutting and filling during the construction of various civil engineering infrastructure.
CO 5	Measure and extract the data from total station and interpret the collected data to make construction layout of different activities.

List of Experiments:

1. Survey of an area by chain, compass survey (closed traverse) & Plotting.
2. Determination of distance between two inaccessible points with compass.
3. Radiation method, intersection methods by plane table survey.
4. Levelling – Longitudinal and cross-section and plotting.
5. Measurement of Horizontal and vertical angle by theodolite.
6. Trigonometric levelling using theodolite.

7. Determination of height, remote elevation, distance between inaccessible points using total station.
8. Determination of Area using total station and drawing map.
9. Stake out using total station.
10. Setting out Curve using total station

Augmented experiments:

1. Profile levelling using Auto level
2. Fly levelling using Auto level (differential levelling)

Reference Books/Laboratory Manuals:

Survey laboratory manual, Department of civil engineering, KSRMCE, Kadapa.

<table>
<tr><td>Course Title</td><td colspan="5">Civil Engineering Workshop (Skill oriented)</td><td colspan="3">B.Tech CE 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">20013S1</td><td rowspan="2">Skill oriented (SOC)</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="6">Mid Exam Duration: 1.5 Hrs</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:
By performing this laboratory, the student will be able

- To Understand the basic properties of materials
- To inculcate the dignity of labor among all students
- Measure to be taken for Safety at workplace and selection of tools
- To work as a member in Team & learn teamwork

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

CO 1	Do setting out of a building plan as per drawings using tape and cross staff.
CO 2	Differentiate different brick bonds and its applications for construct of different masonry walls.
CO 3	Understand the plumbing layout, installation procedure and fixtures used for plumbing.
CO 4	Get awareness on working procedures of plastering, painting & laying of tiles and the materials used for construction of the same.
CO 5	Prepare and test the different composite blocks.

<u>List of Experiments:</u>

1. Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape only.

2. Setting out of a building: The students should set out a building (single room only) as per the given building plan using tape and cross staff.

3. Construct a wall of height 50 cm and wall thickness 1½ bricks using English bond (No mortar required)-corner portion–length of side walls 60cm.

4. Construct a wall of height 50 cm and wall thickness 2 bricks using English bond (No mortar required) - corner portion – length of side walls 60cm.

5. Computation of Centre of gravity and Moment of inertia of a given rolled steel section by actual measurements.

6. Installation of plumbing and fixtures like Tap, T-Joint, Elbow, Bend, Threading.

7. Plastering and finishing of walls.

8. Application of wall putty and painting a wall.

9. Application of base coat and laying of Tile flooring of one square meter

10. Preparation of soil cement blocks for masonry and testing for compressive strength.

Augmented experiments:

1. Casting and testing of Flyash Block.
2. Preparation of cover blocks for providing cover to reinforcement.

Reference Books/Laboratory Manuals:

Civil Engineering Workshop manual, Department of civil engineering, KSRMCE, Kadapa.

B.Tech IV SEM - CE (R20UG)

<table>
<tr><td>Course Title</td><td colspan="4">Business Economics and Accounting for Engineers</td><td colspan="3">B.Tech CE 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">2025401</td><td rowspan="2">Humanities Social Sciences (HSS)</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>
</table>

Course Objectives:

- To equip the budding engineering student with an understanding of concepts and tools
- of economic analysis.
- To provide knowledge of Business economics through differential economics concepts and theories.
- To make aware of accounting concepts to analyze and solve complex problems relating financial related 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

CO 1	Understand the concept of Business Economics and able to apply techniques for demand forecasting.
CO 2	Understand and application the production functions for making business decisions.
CO 3	To Analyze the markets conditions and determine price-output relations.
CO 4	To understand the concepts of accounting and able to prepare the financial statements of a business firm.
CO 5	To evaluate, analyze and interpret the financial performance of a 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

Theory of Production and Cost Analysis:

Production Functions: Law of variable proportion, Isoquants 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

Classification of Markets and Pricing Methods:

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

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

UNIT – V

Financial Analysis Through Ratios: Concept of Financial Ratios - Types of Ratios – Liquidity Ratio, Turnover Ratio, Capital Structure Ratio, Profitability Ratio (Simple problems).

Text Books:

1. Varshney & amp; Maheswari: Managerial Economics, Sultan Chand Publishers, 2009.
2. Prasad and K.V.Rao: Financial Accounting, jaibharth Publishers, Vijayawada.
3. Paul A Samuleson and William nordhaus: Economics, Oxford University Publications. M L Jhingan: Micro Economics & Macro Economics, VrindaPublacations (P) Ltd.
4. Lipsey & Chrystel, Economics, Oxford University Press

Reference Books:

1. P.L Mehtha: Managerial Economics, Sulthan Chand Publishers
2. K KDewett - Managerial Economics,S. Chand Publishers
3. S.P Jain & K.L Narang: Financial Accounting, Kalyani publishers.
4. M.Sugunatha Reddy: Managerial Economics and Financial Analysis, Research India Publication, New Delhi, 2013.

Course Title	Hydraulics & Hydraulic Machinery					B.Tech CE IV Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2001402	Professional Core (PCC)	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 identify the effect of boundary layer aspects and flow around submerged bodies.
- To illustrate the flow characteristics and most economical sections of open channel flow.
- To study the performance characteristics and work done and efficiency curves on impact of jet on vanes.
- Develop students to know the installation, working principles and characteristics of centrifugal pumps.
- Analyze the working principles and operating characteristics of pumps.

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

CO 1	Acquire knowledge on boundary layer theory and its applications in various fields.
CO 2	Understand the hydro dynamic properties of fluids to design economical open channels.
CO 3	Analyse the hydro-dynamic forces on vanes and evaluate velocity triangles.
CO 4	Classify and study performance characteristics of hydraulic turbines.
CO 5	Get knowledge on Classification, losses, efficiencies and limitations of different pumps.

UNIT – I

Boundary Layer Theory: Boundary layer concepts – Thickness of boundary layer - Characteristics of boundary layer along a thin flat plate - Vonkarmen momentum integral equation - Laminar and turbulent boundary layers (no derivation) - Laminar sub-layer separation of boundary layer - Control of boundary layer- Flow around submerged objects – Drag and lift - Magnus effect.

UNIT – II

Open channel flow: Types of flows, Types of channels, Velocity distribution, Chezy's, Manning's and Bazin's formulae for uniform flow, Most Economical sections, Critical flow, Specific Energy, Critical depth, Computation of critical depth; Critical, subcritical and supercritical flows, non-uniform flow, Dynamic equation for gradually varied flow, Types of slopes, Surface profiles, rapidly varied flow, Hydraulic jump and its applications, Surges.

UNIT – III

Impact of Jet on Vanes: Hydrodynamic force of jets on stationary and moving, vertical, inclined and curved vanes, Series of vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, Expressions for work done and efficiency.

UNIT – IV

Hydraulic Turbines: Layout of a typical hydropower installation, Heads and efficiencies, Classification of turbines, Pelton wheel, Francis turbine, Kaplan turbine, Working and working proportions, Velocity diagrams, Work done and efficiency, Hydraulic design, Runaway speed, Draft tube theory, Function and efficiency. Governing of turbines, Surge tanks, Unit quantities and specific speed, Performance of turbines, Characteristic curves, Cavitation, Causes, Effects, Classification of hydropower plants, Load factor, Utilization factor, Capacity factor, Estimation of hydropower potential.

UNIT – V

Pumps: Pumps - Components, Classification; Centrifugal pumps - Classification, Heads, Losses and efficiencies, Limitation of suction lift, Work done, Minimum starting speed, Specific speed; Multistage pumps, Pumps in parallel and series, Performance of pumps, Characteristic curves, Net positive suction head, Priming, Cavitation, reciprocating pumps - Classification, Work done, Slip, Limitations; Special pumps – Self priming pump, Gear pump, Jet pump, Airlift pump; Latest developments in pumps.

Hydropower Engineering: Classification of hydropower plants – Load factor - Utilization factor - Capacity factor – Estimation of hydropower potential.

Text Books:

1. R. K. Rajput, a Textbook of Fluid Mechanics, S. Chand Publishers, 5th Edition, 2013.
2. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publishers, 9th Edition, 2011.
3. Introduction to Fluid Mechanics and Fluid Machines by SK Som, Gautam Biswas, Suman Chakraborthy, Mc Graw Hill Education (India) Private Limited
4. Fluid Mechanics and Hydraulic machines by Manish Kumar Goyal, PHI learning Private Limited, 2015

Reference Books:

1. P. N. Modi and S. M. Seth, Hydraulics and Fluid Mechanics Including Hydraulic Machines, Standard Book House, 20th Edition, 2011**.**
2. Domkundwar and Domkundwar, A Textbook of Fluid Mechanics and Hydraulic Machines, Dhanpat Rai and Co, 6th Edition, 2014.
3. V.T. Chow, Open Channel Flow, 3rd Edition, McGraw–Hill Publishers, 2009.
4. K. Subramanya, Flow in Open Channels, 3rd Edition, Tata McGraw Hill Publishers, 2010.

<table>
<tr><td>Course Title</td><td colspan="5">Soil Mechanics</td><td colspan="3">B.Tech CE 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">2001403</td><td rowspan="2">Professional Core (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>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>
</table>

Course Objectives:

- To familiarize soils' index properties and behavior under different conditions.
- To understand concepts of soil permeability & seepage & their role in groundwater flow.
- To understand the importance of stress distribution in soils and different loaded areas.
- To learn principles of soil compaction &consolidation & their applications in engineering projects.
- To understand the concept of shear strength and familiarize oneself with laboratory testing techniques for soil shear strength and their interpretation.

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

CO 1	Describe soil characteristics by analyzing the soil’s physical and index properties.
CO 2	Apply principles of permeability and seepage to solve problems related to groundwater flow.
CO 3	Estimate stress distribution in soils under various loading conditions.
CO 4	Analyze soil behavior by interpreting the compaction, consolidation properties, and soil settlements.
CO 5	Determine the shear strength of soils by interpreting the laboratory test results.

UNIT - I

Introduction: Definition, origin and formation of soil, List of different soil types, Definition of mass, weight- Relation between mass and weight- Units of mass and weight in SI units-Phase Diagram, Voids ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density, and their interrelationships -clay mineralogy and soil Structure.

Index Properties of Soils and Their Determination: Index Properties of soils and their significance. Various index properties and their Laboratory determination, -Water content, Specific Gravity, Particle size distribution (Sieve analysis and Hydrometer analysis), Relative density, Consistency limits and their indices, in-situ density, Activity of Clay, thixotropy of clay, IS classification - Plasticity chart and its importance.

UNIT - II

Permeability: Types of soil water – capillary rise – flow of water through soils – Darcy's law- permeability – Factors affecting permeability – laboratory determination of coefficient of permeability –Permeability of layered systems.**Seepage Through Soils:** seepage velocity, Seepage pressure, seepage through soils- total, neutral and effective stresses – quicksand condition — flow nets: characteristics and uses

UNIT - III

STRESS DISTRIBUTION IN SOILS: Importance of estimation of stresses in soils – Boussinesq's and Westergaard's theories for point loads, stress distribution in different loaded areas-line load, uniformly loaded circular, strip footing, pressure bulb, variation of vertical stress under point load along the vertical and horizontal planes – Newmark's influence chart.

UNIT - IV

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties – Field compaction Equipment – compaction control – ZAVL.

Consolidation: Types of compressibility, Types of compressibility – Immediate settlement – Primary consolidation and secondary consolidation – Stress history of clay, normally consolidated soil, over consolidated soil and under consolidated soil, pre-consolidation pressure and its determination- Estimation of settlements -Terzaghi's 1-D consolidation theory – Coefficient of consolidation and its determination.

UNIT -V

Shear Strength of Soils: Definition and use of shear strength - Source of shear strength- Normal and Shear stresses on a plane – Mohr's stress circle- Mohr-Coulomb failure theory- Measurement of shear strength, Drainage conditions -Direct shear test, Triaxial shear test, Unconfined compression test and vane shear test – shear strength of granular soil, shear strength of clay, Factors affecting shear strength of granular soils and clay, Liquefaction.

Text Books:

1. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International Pvt. Ltd., 2nd Revised Edition, 2014.
2. K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers and Distributors, 7th Edition, 2014.
3. Geotechnical Engineering by Manoj Dutta & Gulati S.K – Tata McGraw-Hill Publishers New Delhi.
4. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors

Reference Books:

1. Braja M. Das, Principles of Geotechnical Engineering, Cengage Learning India, 7th Edition, 2009.
2. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundation, Laxmi Publications Pvt. Ltd., 16thEdition, 2014.
3. C. Venkatramaiah, Geotechnical Engineering, New Age International Publishers, 3rd Edition, 2010.
4. Lambe, T. W. and Whitman, R. V., Soil Mechanics, John Wiley and Sons, Singapore, 2000.

<table>
<tr><td>Course Title</td><td colspan="5">Structural Analysis</td><td colspan="3">B.Tech CE 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">2001404</td><td rowspan="2">Professional Core (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>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>
</table>

Course Objectives:

- To demonstrate analytical methods for determining strength & stiffness and assess stability of structural members.
- To enable the student, analyze indeterminate trusses
- To make the student to understand the analysis procedures for analyzing fixed andContinuous beams.
- To enable the student to undergo analysis procedure using moment distribution method.
- To enable the student to analyze the two hinged and three hinged arches.

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

CO 1	Analyse the statically indeterminate trusses.
CO 2	Analyse fixed and continuous beams for various loading conditions.
CO 3	Analyse frames and continuous beams using Slope-Deflection Method.
CO 4	Analyse frames and continuous beams using Moment distribution Method.
CO 5	Analyse two hinged and three hinged arches.

UNIT – I

Indeterminate Structural Analysis: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear force – Castigliano's first theorem - Deflections of simple beams and pin jointed trusses - Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies – Solution of trusses up to two degrees of internal and external indeterminacy – Castigliano's second theorem.

UNIT – II

Fixed Beams: Introduction to statically indeterminate beams with U.D.L, central point load and eccentric point load. Number of point loads and uniformly varying loads shear force and bending moment diagrams-Deflection of fixed beams effect of sinking of support.

Continuous Beams: Introduction-Clapeyron's theorem of three moments-Analysis of continuous beams with constant moment of inertia with one or both ends fixed-continuous beams with overhang, continuous beams with different moment of inertia for different spans-Effects of sinking of supports-shear force and Bending moment diagrams.

UNIT - III

Slope-Deflection Method: Introduction- derivation of slope deflection equation-application to continuous beams with and without settlement of supports- Analysis of single bay, single storey, portal frame including side sway.

UNIT – IV

Moment Distribution Method: Introduction to moment distribution method- application to continuous beams with and without settlement of supports. Analysis of single storey, portal frames – including Sway

UNIT – V

Arches: Introduction- hinges-transfer of load to arches-linear arch-hinges in the arch-arch action-Horizontal force – three hinged arches – circular arches – springs at different level-Two hinged arches- two hinged circular arches – fixed arches (only theory) - Temperature stresses in arches.

Text Books:

1. Basic Structural Analysis, C. S. Reddy Tata Mc.Graw-Hill, New Delhi.
2. Analysis of Structures by T.S. Thandavamoorthy, Oxford University Press, New Delhi.
3. Analysis of Structures- Vol. I and II, V. N. Vazirani and M. M. Ratwani, Khanna Publishers, New Delhi.
4. Structural Analysis I Analysis of Statically Determinate Structures, P. N. Chandramouli, Yesdee Publishing Pvt Limited, Chennai

Reference Books:

1. Theory of Structures, B. C Punmia, A. K Jain & Arun K. Jain, Lakshmi Publications.
2. Theory of Structures, R.S. Khurmi, S. Chand Publishers.
3. Structural analysis by R.C. Hibbeler, Pearson, New Delhi.
4. Structural Analysis-I, Hemanth Patel, Yogesh Patel, Synergy Knowledge ware, Mumbai

<table>
<tr><td>Course Title</td><td colspan="4">Transportation Engineering</td><td colspan="3">B.Tech CE 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">2001405</td><td rowspan="2">Professional Core (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>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 Hours</td><td colspan="3">End Exam Duration: 3 Hours</td></tr>
<tr><td colspan="9">Course Objectives:
This course is taught to impart the knowledge in highway planning, alignment, geometric design of different elements of highway, different traffic surveys, traffic regulation and management and pavement design.</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	Conduct different engineering surveys and take up different highway alignment projects.
CO 2	Design highway pavement geometrics.
CO 3	Collect traffic data, analyze the data and design suitable traffic management systems
CO 4	Do structural design of flexible and rigid pavements.
CO 5	Conduct laboratory tests on pavement materials to evaluate their suitability and adaptability for different pavement construction.

UNIT-I

Highway Development and Planning: Highway development in India – Necessity for Highway Planning – Different Road Development Plans – Classification of Roads – Road Network Patterns.

Highway Alignment: Factors controlling alignment, engineering surveys, Drawing and report.

UNIT-II

Highway Geometric Design: Importance of Geometric Design - Highway Cross Section Elements-Sight Distance Elements - Stopping sight Distance, Overtaking Sight Distance, and intermediate Sight Distance - Design of Horizontal Alignment - Design of Super Elevation-Design of Transition Curves -Design of Vertical alignment – Gradients – Vertical curves.

UNIT-III

Traffic Engineering: Basic Parameters of Traffic -Volume, Speed and Density– Highway Capacity-Traffic Volume Studies - Speed studies - Road Accidents – Condition Diagram and Collision Diagrams. Traffic Regulation and Management: Road Traffic Signs – Road markings -Types of Road Markings- Design of Traffic Signals – Webster Method – Saturation flow – Phasing and timing diagrams – Numerical problems.

UNIT-IV

Pavement Design: Types of pavements – Difference between flexible and rigid pavements – Pavement Components – Functions of pavement components – Design Factors – Design methods – IRC methods only (as per IRC 37-2002) – Design of Rigid pavements – Critical load positions – Westergaard's stress equations – Stresses in rigid pavements.

UNIT-V

Highway Materials and construction practice: Desirable Properties and Testing of Highway Materials-Aggregate-Crushing, Abrasion, Impact Tests, Water absorption, Flakiness and Elongation Indices-Tests on Bitumen-Penetration, Ductility, Viscosity and Softening point Tests-Construction Practice-Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORT&H specifications]-Highway Drainage.

Text Books:

1. S K Khanna, C E G Justo, and A. Veeraragavan "Highway Engineering", Nemchand Publications, New Delhi.
2. Papacoastas, C. S. and Prevedouros, Transportation Engineering and Planning, Third Edition, Third Impression; Pearson Education, 2018
3. Subhash C Saxena, Text Book of Highway and Traffic Engineering; First Edition; CBS Publishers and Distributors. New Delhi, 2014
4. Nicholas J Garber and Lester AHoel, Traffic and Highway Engineering, 5th Edition, Cengage Learning India Private Limited, New Delhi, 5th Indian Reprint, 2018

Reference Books

1. G V Rao "Principles of Transportation and Highway Engineering", Tata McGraw-Hill Companies, Inc. New York.
2. L R Kadiyali "Principles and Practice of Highway Engineering", Khanna Publishers, New Delhi.
3. ParthaChakroborthy, Animesh Das, "Principles of Transportation Engineering", Prentice Hall of India, New Delhi.

<table>
<tr><td>Course Title</td><td colspan="5">Building Planning and Drawing (AutoCAD)</td><td colspan="3">B.Tech CE 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">2001406</td><td rowspan="2">Engineering Science (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">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
To Understand various types of conventional signs and brick bonds.
To Draw the plan section and elevation for doors, trusses, and staircases.
To Use AutoCAD tools to draw building plans, sections and elevations from a given
line diagram and specifications.
To prepare plan, section & elevation of residential building
To Develop working drawings of residential buildings.</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">Interpret the symbols, signs, and conventions from the given drawing.</td></tr>
<tr><td>CO 2</td><td colspan="8">Create layout plan, sanction drawings of doors, trusses and staircases.</td></tr>
<tr><td>CO 3</td><td colspan="8">Prepare any type of building drawing using AutoCAD software.</td></tr>
<tr><td>CO 4</td><td colspan="8">Draw plan, elevation, and sections in AutoCAD</td></tr>
<tr><td>CO 5</td><td colspan="8">Develop working layouts of Electrical and plumbing drawings for residential building</td></tr>
</table>

<u>List of Experiments:</u>

1. Introduction to Computer Aided Drafting and Conventional Signs.
2. Brick bonds: English bond & Flemish bond – Odd and Even courses.
3. Drawing elevation of a King Post Truss.
4. Drawing elevation and section of a fully panelled door.
5. Developing plan and section of dog-legged staircase.
6. Developing plan of single storied residential building.
7. Developing section and elevation of single storied residential building.
8. Developing plan of two storied residential building.
9. Developing section and elevation of two storied residential building.
10. Development of working drawing of building – Electrical and Plumbing Layout

Text Books:

1. Civil Engineering Drawing-I by N. Sreenivasulu, S. Rama Rao – Radiant PublishingHouse.
2. Civil Engineering Drawing-II by N. Sreenivasulu – Radiant Publishing House.

Reference Books:

1. Engineering Graphics by P. J. Sha - S. Chand & Co.
2. Civil Engineering Drawing-I by S. Mahaboob Basha – Falcon Publishers
3. Building drawing by M. G. Shah - Tata McGraw-Hill Education.

<table>
<tr><td>Course Title</td><td colspan="4">Soil Mechanics Laboratory</td><td colspan="4">B.Tech CE 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">2001407</td><td rowspan="2">Professional Core (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>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">Mid Exam Duration: ----</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- To Identify index properties of soil and determine the field density.
- To Analyze the shear parameters and engineering properties of soil.

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

CO 1	Understand the index properties of soil with reference to Indian Standard Code of Practice.
CO 2	Identify the stress history and general properties of soil met with construction.
CO 3	Analyse the field compaction control and compare its results to the laboratory compaction test.
CO 4	Compare the shear characteristics of soil for testing, performing the test, collecting and analyzing data according to ASTM.
CO 5	Apply the laboratory results to problem identification, quantification, and basic soil mechanics related design problem.

<u>Index Properties of Soil:</u>

1. Determination of water content and specific gravity.
2. Grain size analysis – sieve analysis and hydrometer analysis.
3. Tests for Atterberg’s limits.

a) Determination of liquid limit – Casagrande’s method and cone penetrometer method.

b) Determination of plastic limit.

c) Determination of shrinkage limit.

4. Determination of field density – core cutter method and sand replacement method.

<u>Engineering Properties of Soil:</u>

5. Standard Proctor’s compaction test and Modified compaction test.
6. Permeability of soil – constant head test and variable head test.
7. CBR Test.
8. Direct shear test.
9. Unconfined compression test.

10. Vane shear test

Augmented experiments:

1. Tri–axial compression test.
2. Consolidation test.

Reference Books/Laboratory Manuals:

Geotechnical Engineering Laboratory Manual, KSRMCE, Kadapa.

<table>
<tr><td>Course Title</td><td colspan="4">Transportation Engineering Laboratory</td><td colspan="3">B.Tech CE 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">2001408</td><td rowspan="2">Professional Core (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>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">Mid Exam Duration: ----</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
Identify the properties and behavior of highway material for different loading patterns.
Demonstrate tests on transportation materials like aggregate, sand etc. and check their Suitability.
Understand the properties of aggregates by conducting specific gravity and shape of aggregates.
Identify the various properties of bitumen material and to obtain the grade of bitumen used for application of aggregate mix.</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 basic properties of sand and aggregates for determining their suitability through various laboratory tests.</td></tr>
<tr><td>CO 2</td><td colspan="8">Identify the problems associated with roads based on the properties to suggest the appropriate remedy.</td></tr>
<tr><td>CO 3</td><td colspan="8">Determine mechanical properties of aggregates in laboratory for deciding its suitability in construction practice.</td></tr>
<tr><td>CO 4</td><td colspan="8">Outline the various properties of bitumen material to obtain the grade of bitumen.</td></tr>
<tr><td>CO 5</td><td colspan="8">Utilize the concept on properties of aggregates and binding materials for design of roads.</td></tr>
</table>

List of Experiments

Road Aggregates:

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Attrition Test
5. Abrasion Test.
6. Shape tests

Bituminous Materials:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.

Text Books:

1. G Venkatappa Rao, K Ramachandra Rao, Kausik Pahari and D V Bhavanna Rao "Highway Material Testing and Quality Control", I K International Publishing House Pvt. Limited, New Delhi.

Reference Books:

1. Ajay K Duggal and Vijay P Puri "Laboratory Manual in Highway Engineering", New Age International (P) Limited, Publishers, New Delhi.
2. S K Khanna, C E G Justo and A Veeraraghavan "Highway Engineering", Nem Chand & Bros Publishers, Roorkee, Uttarakhand.

<table>
<tr><td>Course Title</td><td colspan="4">Advanced Civil Engineering Workshop</td><td colspan="3">B.Tech CE 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">20014S2</td><td rowspan="2">Skill Oriented (SOC)</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="6">Mid Exam Duration: ----</td><td colspan="3">End Exam Duration: 3 Hours</td></tr>
</table>

Course Objectives:

- To enable the students to determine the properties, identification of civil engineering materials and Tests on Brick.
- To enable the students to determine test on Cement and Aggregate.
- To enable the students to know about of Construction of masonry brick wall.
- To know the Design concrete mixes as per IS codes.
- To enable the students give demonstration about bar bending, house wiring and painting.

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

CO 1	Gain basic knowledge of Workshop Practice and Safety useful for our daily living.
CO 2	Demonstrate cement and aggregate properties for construction purpose
CO 3	Construction of masonry brick walls by using Bonds
CO 4	Design concrete mixes as per IS codes
CO 5	To reveal the importance of Wall Painting, House wiring, Shuttering and Scaffolding

1. **Properties and Identification of Civil Engineering Materials:** Properties and identification of building materials-Market survey for building materials.
2. **Tests on Brick:** Visual inspection test for colour, shape and size-Soundness of brick-Water absorption test of brick-Efflorescence test of brick-Compressive strength of brick.
3. **Tests on Cement:** Fineness of cement by dry sieving-Standard consistency of cement.
4. **Tests on Fine Aggregate:** Sieve Analysis of Fine aggregate-Specific gravity of Fine aggregate-Bulking of Fine aggregate.
5. **Masonry:** Construction of masonry brick wall using English bond-Construction of masonry brick wall using Flemish bond.
6. **Concrete Mix Design:** As Per IS Method

7. **Bar Bending and Reinforcement:** Bar bending of reinforcement skeleton for foundations, columns, beams.
8. **Painting:**External wall painting-Internal wall painting
9. **House Wiring:** 16 A Line-6 A Line
10. **Shuttering And Scaffolding:** Shuttering for beams and slabs-Shuttering for columns and Walls-Steel scaffolding-Single and double scaffolding.

Reference Books/Laboratory Manuals:

1. Civil Engineering Workshop Laboratory Manual, KSRMCE, Kadapa.
2. S. K. Duggal, Building Materials, New Age International Publishers, 4th Edition, 2010.
3. A. M. Neville, Properties of Concrete, John Wiley and Sons, New Delhi, 5th Edition, 2012.

IS Codes:

1. IS 1077 – 1992: Brunt Clay Building Brick.
2. IS 4031 - 1988: Chemical Analysis and Tests on Cement.
3. IS 383 - 1970: Coarse and Fine Aggregates.
4. IS 10264 - 2009: Mix Design of Concrete.
5. IS 1199 - 1959: Methods of Sampling and Analysis of Concrete.
6. IS 13311- 1992: Method of Non-destructive Testing of Concrete.
7. IS 7293 - 1974: Safety Code for Working with Construction Machinery.
8. IS 2212 - 1991: Code of Practice for Brick Work.
9. IS 2502 – 1993: Code of Practice for Bar Bending and Fixing of Bars.
10. IS 2395(1) - 1994: Code of Practice for Painting Concrete, Masonry.
11. IS 732 – 1989: Code of Practice for Electrical Wiring Installations.
12. IS 14678 - 1999: Guidelines for False work for Concrete Structures

<table>
<tr><td>Course Title</td><td colspan="4">Universal Human values</td><td colspan="3">B.Tech CE 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">2024410</td><td rowspan="2">Humanity Sciences (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>0</td><td>0</td><td>0</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:
Objective of this course is to make the students

- 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, medicines, 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 Scherzinger. "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 andProfessional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1.

B.Tech V SEM - CE (R20UG)

<table>
<tr><td>Course Title</td><td colspan="4">Hydrology & Irrigation</td><td colspan="4">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">2001501</td><td rowspan="2">Professional Core (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>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: 1.5 Hrs</td><td colspan="4">End Exam Duration: 3 Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• The students acquire knowledge about hydrologic cycle, precipitation its measurement. To understand the precipitation forms, evaporation. types measurements.
• To study the Infiltration, surface runoff, floods and its importance and effects.
• Introduction to the types of irrigation systems and planning and design of irrigation systems.
• To Learn design principles of Diversion Head works.
• To Study the classification of dam their importance, applications.</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 thoroughly theories and principles governing the hydrologic cycle.
CO 2	Estimate the flood discharge using different methods.
CO 3	Estimate consumptive usage of irrigation water for different crops and to design irrigation canals and canal network.
CO 4	Know the factors effecting the selection of site and design of dams and reservoirs.
CO 5	Analyse the stability of gravity and earthen dams.

UNIT-I

Introduction

Definition of hydrology – Hydrologic cycle; Precipitation: Types and forms of precipitation, Measurement – Recording and non-recording type of rain gauges– Average depth of precipitation – Double mass curve; Mean Precipitation: Arithmetic Mean, Thiessen Polygon and Isohyet Methods; Evaporation, Transpiration, Evapotranspiration – Factors affecting – Estimation and Measurement – Methods to Reduce evaporation.

UNIT – II

Infiltration

Factors affecting Infiltration, Measurement of Infiltration, Infiltration Curve and Infiltration Indices; Runoff: Components – Factors affecting – Features of hydrograph – Separation of base flow –Direct runoff hydrograph, Unit hydrograph; Flood Estimation: Introduction– Methods– Rational Method & Empirical formulae.

UNIT – III

Irrigation

Necessity and importance, principal crops and crop seasons – Types - Methods of application - Consumptive use - Estimation of consumptives use - Crop water requirement - Duty and delta - Factor affecting duty - Irrigation efficiencies - Water logging - Standard of quality for irrigation - Crop rotation.

Flow irrigation

Classification of canals - Design of Irrigation canals by Kennedy's and Lacey's theories.

UNIT – IV

Diversion head works - Weirs and barrages - Layout of diversion head works – Components - Causes and failure of hydraulic structures. Types of dams - Merits and demerits - Factors affecting selection of type of dam - Factors governing selecting site for dam - Types of reservoirs.

UNIT – V

Storage head works

Gravity dams: Forces acting on gravity dam - Causes of failure of a gravity dam - Elementary profile and practical profile of a gravity dam - Limiting height of a low gravity dam - Drainage galleries.

Types of Earth dams: Causes of failure of earth dam - Criteria for safe design of earth dam.

Text Books:

1. Mays, L.W. and K. Tung, "Hydro systems Engineering and Management", McGraw-Hill Inc., New York, 1992.
2. P. Jayarami Reddy, "A Text Book of Hydrology", Laxmi Publications, Third edition, 2016.
3. H.M. Raghunath, "Hydrology: Principles, Analysis, Design: Principles, Analysis and Design", New Age International Pvt Ltd, Third edition, 2015.
4. S.R. Sahasrabudhe, "A Textbook of Irrigation Engineering", S.K. Kataria & Sons, 2013

Reference Books:

1. Aswathanarayana U., "Water Resources Management and the Environment", A.A. Balkema Publishers, 2001

2. K.C.Parti, "Hydrology and Water Resources Engg", Narosa Publishers, 2001.

<table>
<tr><td>Course Title</td><td colspan="4">Foundation 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">2001502</td><td rowspan="2">Professional Core (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>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>
</table>

Course Objectives:

- To emphasize the importance of soil investigations including destructive and non-destructive methods
- To explain how earth pressure theory is important in retaining structure design
- To explain the concept of bearing capacity and how to estimate the safe bearing capacity for various foundation systems including settlement consideration
- To explain in what circumstances pile is needed and how do analysis the pile and pile group under various soil conditions
- To study the types of slopes for different conditions

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

CO 1	Carry out soil investigation for any civil engineering construction
CO 2	Analyze earth retaining structures for any kind of soil medium
CO 3	Perceive knowledge to design shallow and deep foundations
CO 4	Determine bearing capacity and foundation settlement
CO 5	Understand various methods for computation of factor of safety for any type of slope condition

UNIT-I

Site Investigation & Sub-Soil Exploration

Site reconnaissance – Depth of exploration – Lateral extent of exploration – Test pits – Auger borings – Wash borings – Soil samplers – Penetration test – Standard penetration test (SPT) – Geophysical methods – Seismic refraction and electrical resistivity methods – Sub soil investigation reports - Plate load test – Pressure meter.

UNIT – II

Earth Pressure Theories and Retaining Walls

Active and passive earth pressures in cohesion less and cohesive soils (with and without surcharge, horizontal and inclined surfaces) - Rankine’s theory of earth pressure – Earth pressures in layered soils – Coulomb’s earth pressure theory – Culmann’s and Rebhann’s graphical method. Types of retaining walls – Stability of gravity and cantilever retaining walls – Drainage in retaining walls.

UNIT – III

Bearing capacity of shallow foundations

Types of foundations – Depth of foundation – Terzaghi's bearing capacity equation – Bearing capacity of strip, square, circular, rectangular footings – Meyerhof's theory – Skempton's method – Brinch Hansen's method – Effect of ground water table on bearing capacity – Bearing capacity from building codes – Tolerable settlements – Settlement analysis.

UNIT – IV

Pile Foundations

Types of piles – Load carrying capacity of piles based on Static pile formulae – Dynamic pile formulae – Pile Load tests - Load carrying capacity of pile groups in sands and clays – Settlement of pile groups - Negative skin friction.

UNIT – V

Earth Slope Stability

Infinite and finite earth slopes – Types and causes of failures – Factor of safety of infinite slopes – Stability analysis by Swedish arc method, Standard method of slices, Bishop's simplified method – Taylor's stability number- Stability of slopes of earth dams under different conditions.

Text Books:

1. Professor John N. Cernica, P.E., Ph.D., "Geotechnical Engineering: Soil Mechanics", by John Wiley & Sons, Inc., New York.
2. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain "Soil Mechanics & Foundation Engineering", Laxmi Publications, New Delhi.
3. Dr. K R Arora "Soil Mechanics & Foundation Engineering", Standard Publishers Distributers, New Delhi.
4. Braja M. Das, "Fundamentals of Geotechnical Engineering", Cengage Learning, USA.

Reference Books:

1. Joseph E. Bowles "Foundation analysis & Design", Tata McGraw-Hill Companies, Inc. New York.
2. R. Whitlow, "Basic Soil Mechanics", Addison Wesley Longman Limited, Edinburgh Gate, England.

<table>
<tr><td>Course Title</td><td colspan="4">Concrete Technology</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">2001503</td><td rowspan="2">Professional Core (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>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>
</table>

Course Objectives:

- To understand the different types of cements & admixtures available in construction industry and their properties.
- To understand the basic requirement so of aggregate used for concrete and properties of fresh concrete.
- To understand the durability properties of concrete.
- To understand the mechanical properties of concrete.
- To design a concrete mix for various grades of concrete

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

CO 1	Know the types of cements, admixtures available in market and their properties.
CO 2	Evaluate properties of aggregates and fresh concrete.
CO 3	Know about elasticity, shrinkage, creep and durability of concrete.
CO 4	Evaluate properties of hardened concrete.
CO 5	Design the concrete mix proportions by suing ACI and IS methods.

UNIT-I

Cements and Admixtures

Portland cement – Chemical composition – Hydration, Setting of cement – Types of cements - Tests on physical properties – Different grades of cement – Introduction to Mineral and chemical admixtures, their functions, uses and dosages.

UNIT – II

Aggregates & Fresh Concrete

Concrete aggregates: Classifications – Strength and other mechanical properties – Moisture content and its effects – Deleterious substances – Alkali-Aggregate reaction – Grading curves and grading requirements – Gap-graded aggregate.

Fresh concrete: Workability – Factors affecting workability – Measurements of workability – Effect of time and temperature – Segregation – Bleeding – Mixing of concrete – vibration of concrete – Pumped concrete, underwater concrete, pre-placed concrete, Ready mixed concrete– Pumped concrete.

UNIT – III

Properties of Concrete

Elasticity, Shrinkage and Creep: Modulus of elasticity – Dynamic modulus – Poisson's ratio– Shrinkage and its effects – Creep of concrete – Factors affecting creep.

Durability: Introduction, types of durability tests – Chemical attack of Concrete – Efflorescence – Air entrained concrete – Thermal properties – Resistance of concrete to fire.

UNIT – IV

Hardened Concrete

Curing of concrete: Methods of curing – Maturity - Influence of temperature – Steam curing at atmospheric pressure – High pressure steam curing

Hardened concrete: Compression tests – Flexure test –Splitting test – Rebound Hammer test– Ultrasonic pulse velocity test, Digital Image Processing.

UNIT – V

Mix Design of Concrete

Concrete Mix Design and Quality Control: Basic consideration – Objectives - Principles of Mix Proportioning-Factors in the choice of properties– Procedure for ACI & IS methods of mix design - Simple example of mix design.

Text Books:

1. A M Neville, "Properties of Concrete", Pearson Education India, 5th edition, 2012.
2. P.K.Mehta and J.M.Monteiro, "Concrete: Micro Structure, Properties and Materials", McGraw Hill Publishers, 4th edition, 2013.
3. M S Shetty "Concrete Technology", S. Chand Publishers, New Delhi.
4. A R Santha Kumar "Concrete Technology", Oxford University Press, New Delhi.

Reference Books:

1. M L Gambhir "Concrete Technology", Tata McGraw-Hill Companies, Inc. New York.
2. P K Mehta and J M Monteiro "Concrete: Micro structure, Properties and Materials", Tata McGraw-Hill Companies, Inc. New York.
3. Krishna Raju "Design of Concrete Mix", CBS Publishers, New Delhi.
4. J Prasad and C G K Nair "Non-Destructive Test and Evaluation of Materials", Tata McGraw-Hill Companies, Inc. New York.

<table>
<tr><td>Course Title</td><td colspan="5">Optimization Techniques in 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">2001504</td><td rowspan="2">Professional Elective (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>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>
</table>

Course Objectives:

- Understand the importance optimization to various practice problems and solve them simple mathematical techniques.
- The various optimization techniques for single variable optimization problem
- Direct search methods and Gradient methods for multi variable un constraint Optimization problems

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

CO 1	Apply the concept of basic mathematics for various optimization techniques.
CO 2	Know about one-dimensional optimization techniques civil engineering problems.
CO 3	Understand the constrained and unconstrained optimization techniques.
CO 4	Apply the dynamic programming techniques to solve problem in civil engineering.
CO 5	Appraise the integer programming techniques.

UNIT-I

Introduction to Optimization

Engineering applications, Statement of optimization, classification of optimization, Classical optimization: Single variable, multi variable with and without optimization. Mutli variable with inequality constraints Khun -Tucker conditions.

UNIT – II

One Dimensional Minimization

Uni-modal Function, Unrestricted search, Exhaustive search, Dichtomous search, Interval Halving method, Fibonici and golden bisection Method, Newton and Quasi Newton method.

UNIT – III

Non-Linear –Unconstrained optimization-I

Classification, scaling of design variables, Random search methods, Univeriate search, pattern Directions, Hook Jeeves, Powel method, Rosenbrock method.

<u>UNIT – IV</u>

Non-Linear –Unconstrained optimization-II

Characteristics, Random search methods, complex method, sequential linear programming, Zoutendijk's method, Penality method.

<u>UNIT – V</u>

Dynamic programming:

Multi stage decision processes, concept of sub optimization, few examples problems

Integer programming: Gomory's cutting plane method, branch and bound method.

<u>Text Books:</u>

1. David G. Luerbeggan, "Introduction to Linear and Non Linear Programming", Addison Wesley Publishing Co. 1973.
2. Hadley G. "Nonlinear and – dynamic programming" Addison Wesley Publishing Co. 1964.
3. HarndyA.Tahh. "operations Research, An Introduction", Macmillan Publishers Co. NewYork,1982.
4. J.K Sharma: Operations Research, S Chand ,9th edition, New Delhi

<u>Reference Books:</u>

1. Cordan C.C. Beveridge and Robert S. Schedther, "Optimization, Theory and Practice" McGraw Hill Co.1970.
2. SS. Rao, "Engineering Optimization theory and practice", New age international 3rd edition 2013.
3. Jasbir.S. Arora, "Introduction to Optimum Design" Mc Graw hill International edition, 4th edition Singapore.
4. M. C. Joshi, K. M. Moudgalya, "Optimization Techniques theory and practice", Narosa Publications
5.

<table>
<tr><td>Course Title</td><td colspan="4">Advanced Structural Analysis</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">2001505</td><td rowspan="2">Professional Elective (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>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>
</table>

Course Objectives:

- To introduce stiffness method and flexibility method for analysis of statically indeterminate structures.
- To understand the basics of finite element method and application to structural analysis.
- Use and/or develop structural analysis software to analyze complicated structural systems.
- Interpret the output from computer-based analyses for the purpose of structural design

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

CO 1	Identify static and dynamic indeterminacy of structure and can apply matrix methods to analyse the structures.
CO 2	Analyse the continuous beams using stiffness and flexibility methods.
CO 3	Analyse two dimensional portable frames using stiffness and flexibility methods.
CO 4	Analyse two-dimensional pin-jointed trusses using stiffness and flexibility methods.
CO 5	Transform local coordinate system to global coordinate system in matrix methods.

UNIT-I

Introduction to Matrix methods

Introduction, coordinate systems, displacement and force transformation matrices, element and structure stiffness matrices, Element and structure flexibility matrices, equivalent joint loads, stiffness, and flexibility approaches.

UNIT – II

Matrix methods for beams

Analysis of continuous beams by flexibility method and stiffness method with and without settlement of supports.

UNIT – III

Matrix methods for Plane Frames

Analysis of 2-D frames by Flexibility matrix methods.

UNIT – IV

Matrix methods for Plane Frames

Analysis of 2-D frames by Stiffness matrix methods.

UNIT – V

Matrix methods for Plane truss problems

Analysis of 2-D trusses by flexibility method and stiffness method.

Text Books:

1. G. S. Pandit and S. P. Gupta, “Structural Analysis - A Matrix Approach”, McGraw Hill Education; 2nd edition,2008.
2. M W Weaver and Gere, “Matrix Analysis of framed Structures”, Springer, 1990.
3. S.S. Bhavikatti, “Matrix Methods of Structural Analysis”, Dreamtech Press, 2019
4. S. Ramamrutham, R. Narayan, “Theory of Structures”, 9th Edition, 2014.

Reference Books:

1. Devdas Menon, “Advanced Structural Analysis”, Narosa Publishing House, 2015.
2. Asslam Kassimali, “Matrix Analysis of Structures”, Cengage Learning, USA. 2012.
3. C.K Wang, “Analysis of Indeterminate Structures”, Tata McGraw-Hill Companies, Inc. New York, 1992.
4. T.N.Gayl, “Matrix structural analysis”, Tata Mc Graw Hill Company.

Course Title	Remote Sensing & GIS					B.Tech CE V Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2001506	Professional Elective (PEC)	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 purpose of this course is to provide an understanding of physical concepts and underlying various engineering and technological applications in remote sensing. In addition, the course is expected to understand the basic principles of remote sensing and its applications.

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

CO 1	Perceive the basics of remote sensing
CO 2	Pick out the characteristics of the instruments used for remote sensing
CO 3	Analyze the need and standard techniques used for image processing
CO 4	Perceive the basics of GIS
CO 5	Study the areas of application of Remote Sensing and GIS

UNIT-I

Remote Sensing – 1

Introduction to Basic Concepts: Definition – Physics of Remote Sensing – Electro Magnetic Radiation (EMR) – Interaction of EMR with atmosphere, Earth surface features – Vegetation, soils, water – Spectral reflectance curves – Atmospheric windows

UNIT – II

Remote Sensing – 2

Remote Sensing Systems: Platforms: Introduction – Types – Satellites and orbits, - Spectral, radiometric and spatial resolutions, temporal resolution of satellites - Some remote sensing satellites and their features.

UNIT – III

Image Processing Techniques

Digital Image Processing: Image enhancement – Contrast stretch, Spatial filtering and edge enhancement; Classification – Supervised unsupervised classification – Visual image interpretation techniques.

UNIT – IV

Geographical Information Systems (GIS)

Basic Principles – Definition – Components – Data Structures – Raster and Vector formats – Functioning of GIS – Data Input – Data Manipulation – Data Retrieval – Spatial Data Analysis – Computational Analysis Methods (CAM) – Visual Analysis Methods (VAM) - Data Display – Data Base Management Systems

UNIT – V

Remote Sensing Applications

Remote Sensing Applications: Water resources - Drought Assessment - Environmental Monitoring.

Text Books:

1. Thomas Lillesand, Ralph W Kiefer and Jonathan Chipman, "Remote Sensing and Image Interpretation", John Wiley & Sons, India.
2. M Anji Reddy, "Remote Sensing & GIS", B.S Publications, Hyderabad.
3. C P Lo and Albert K W Yeung, "Concepts and Techniques in Geographical Information Systems", Prentice Hall of India, New Delhi.
4. Tor Bernhardsen, "Geographic Information systems – An Introduction", Wiley India Publication, 3rd Edition, 2010.

Reference Books:

1. Floyd F Sabins Jr., "Remote Sensing Principles and Interpretation", Freeman and Co., San Francisco.
2. J R Jensen, "Remote Sensing of the Environment: An Earth Resource Perspective", Prentice Hall of India, New Delhi.
3. Michael N. Demers, "Fundamentals of Geographic Information systems", 4th Edition, Wiley Publishers, 2012.
4. Basudeb Bhatta, "Remote Sensing and GIS", Oxford University Press, 2nd Revised Edition, 2011

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, 2^{nd} 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, 3^{rd} 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><td>Course Title</td><td colspan="5">Rapid Prototyping</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">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="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 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.

<u>UNIT - I</u>

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.

<u>UNIT - II</u>

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.

<u>UNIT - III</u>

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><th>Course Title</th><th colspan="5">Design for Manufacturing and Assembly</th><th colspan="3">B.Tech ME V Sem</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">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

<table>
<tr><td>Course Title</td><td colspan="4">Energy Systems in Engineering</td><td colspan="4">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">20OE304</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>
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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 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><td>Course Title</td><td colspan="4">Smart Materials</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">20OE305</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

- 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">Overview of Microcontrollers</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">20OE401</td><td rowspan="2">OE</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuou s 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: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
To become familiar with 8051, MSP 430, PIC and ARM controllers.</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 types of Microcontrollers.</td></tr>
<tr><td>CO 2</td><td colspan="8">Define various components and list out various features of microcontrollers.</td></tr>
<tr><td>CO 3</td><td colspan="8">Describe the various blocks of 8051, MSP 430, PIC and ARM microcontrollers</td></tr>
</table>

UNIT I

Introduction: Microcontrollers, Vonneumann Vs Harvard, CISC vs RISC, Types of Microcontrollers, Examples of Microcontrollers, Selection of a microcontroller, Microcontroller resources, Applications.

UNIT II

The 8051 Architecture: Introduction, architecture of 8051, pin diagram, internal RAM memory organization, Special Function Registers, external memory interfacing-ROM & RAM, stack, timers and interrupts.

UNIT III

MSP 430 Microcontroller: The Outside View—Pin-Out, The Inside View—Functional Block Diagram, Memory, Central Processing Unit, Memory-Mapped Input and Output, Clock Generator, Exceptions: Interrupts and Resets.

UNIT IV

PIC Microcontrollers: Overview and Features, Architecture Details of PIC 16C6X/7X, I/O Ports, Interrupts, Timer, ADC, Features of 16F8XX series.

UNIT V

ARM Architecture: RISC Design philosophy, ARM Design philosophy, Registers, Program Status Register, Instruction pipeline, Interrupts and vector table.

Text Books:

1. Raj Kamal, "Microcontrollers - Architecture, Programming, Interfacing and System Design"- Second Edition, Pearson, 2012.
2. John H Davis, "MSP 430 Microcontroller Basics", Newnes publishers, 2008.
3. Andrew N.Sloss, Dominic Symes, Chris Wright "ARM System Developer's Guide- Designing and Optimizing system software", Elsevier, 2008.
4. Ajay V Deshmukh, "Microcontrollers: Theory and Applications", TMH, 2005.

Reference Books:

1. Mazidi Muhammad Ali, Mazidi Janice Gillespie &McKinlayRolin D, *The 8051Microcontroller and Embedded Systems*, 2nd Edition, Pearson Education, 2008.
2. Design with PIC Microcontrollers – John B. Peatman, Pearson Education, 2005.

Course Title	**Industrial electronics**					**Open Electives**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE402	**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 understand working of semiconductor devices.
- To gain the knowledge of AC to DC, AC to AC and DC to DC converters.

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

CO 1	Understand the basics of Power Electronics.
CO 2	Learn the details of power semiconductor switches (Construction, Characteristics and operation)
CO 3	Understand the working of various types of converters.
CO 4	Learn how to analyze the converters and design the components of them, under various load types.
CO 5	Learn about the control of various converters

Unit-I

Power Semiconductor devices: Constructional features, Operating Principle, Characteristics and specification of power semiconductor diode, Power Bipolar Junction transistor (BJT), Thyristors and Triacs, Gate Turn off Thyristors (GTO), Metal oxide semiconductor field effect transistor (MOSFET), Insulate Gate Bipolar transistor (IGBT), Hard and soft switching of Power semiconductors.

Unit-II

AC to DC Convertors: Single Phase uncontrolled rectifier, Single Phase fully controlled rectifier, single phase half controlled bridge rectifier, Operation and analysis of three phase fully controlled bridge converter, Operation and analysis of three phase half controlled converter, Effect of source Inductance on the performance of AC to DC converters, Power factor improvement, Harmonic reduction, filter.

Unit-III

DC to DC Converters: Types of basic DC-DC converters, Analysis of Buck converter (DC-DC) circuit, Commutation of thyristor based circuits, Introduction to switched mode power supply

(SMPS) circuits, Fly-back type switched mode power supply, Forward type switched mode power supply, Design of transformer for switched mode power supply circuits.

Unit-IV

AC to AC Voltage converter: Three phase AC regulators, Phase angle control in Traic based single Phase AC regulators, Introduction to cyclo converters, three phases to single phase cyclo converters, three phase to three phase cyclo converters, Control circuit for three phase to three phase converter.

Unit-V

Introduction to voltage source Inverters, Analysis of 1-Phase square wave voltage source Inverter, 3-Phase voltage source with square wave output. 3-phase pulse width modulated inverter. Sine PWM and its realization, current source Inverter, Load commutated current source inverter.

Text Books:

1. M. D. Singh and K. B. Khanchandani," Power Electronics".

2. Ned Mohan, Tore M. Undeland, and William P. Robbins,"Power Electronics: Converters, Applications And Design, Media Enhanced (With CD)".

3. John G. Kassakian, Martin F. Schlecht, and George C. Verghese,"Principles Of Power Electronics".

Reference Books:

1. G. K. Mithal , Maneesha Gupta, "Industrial and Power Electronics", Khanna Publishers,1987.
2. George M. Chute, R. D. Chute, "Electronics in Industry", McGraw-Hill School Pub Co, 5^{th} Edition

<table>
<tr><td>Course Title</td><td colspan="4">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 rowspan="2">Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr></tr>
<tr><td rowspan="2">20OE501</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 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

CO 1	Understand the variety of abstract data types and data structures.
CO 2	Analyze data structures such as linked list, Stacks and Queues.
CO 3	Apply and analyze tree traversal algorithms and graph traversal algorithms.
CO 4	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:** 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.

Course Title	**Database Management Systems (Open Elective Course – I)**			**B.Tech V Sem (R20) CSE**
Course	**Category**	**Hours/Week**	**Credi**	**Maximum Marks**

Code						ts			
20OE502	OE C	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs			

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", 5th Edition, 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.

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="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>
<tr><td rowspan="2">20OE3901</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>
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</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.
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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.

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Balanced Search Trees: AVL trees, Red-Black trees & Splay trees.

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Searching: Linear and Binary search.

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2. Fundamentals of Data Structures in C, Horowitz, Sahni, Anderson Freed, Universitiespress.
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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="5">OOP THROUGH C++
(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>
<tr><td rowspan="2">20OE3902</td><td rowspan="2">PJ</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 Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

Course Objectives:

- To make the students understand the features of object-oriented design and familiarize them with virtual functions, templates and exception handling.
- To enable the students solve various engineering problems in C++ programming language.

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

CO 1	Understand the fundamentals of C++
CO 2	Explain the concept of Tokens and Control Structures.
CO 3	Illustrate the concept of Classes and Objects.
CO 4	Demonstrate the concept of Operator overloading and Inheritance.
CO 5	Understand the concept of Pointers, Virtual functions and Polymorphism

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 aclass, 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, Pure virtual 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><th>Course Title</th><th colspan="5">Employability Skills</th><th colspan="3">B.Tech.
Open Elective-I</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">20OE601</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 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">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, 9^{th} 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, 7^{th} Edition, Curtis F. Gerald, Patrick O. Wheatley.
4. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 10^{th} edition Reprint 2021.

Reference Books:

1. Chapra.S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5^{th} Edition, New Delhi, 2007.
2. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3^{rd} 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.

<table>
<tr><td>Course Title</td><td colspan="4">ENGINEERING MATERIALS</td><td colspan="4">OPEN ELECTIVE- 2</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"></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.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).

<table>
<tr><td>Course Title</td><td colspan="5">Basics of Nanotechnology</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>
<tr><td rowspan="2">20OE604</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 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.</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">Acquire knowledge about structure and properties of nano materials</td></tr>
<tr><td>CO 2</td><td colspan="8">Synthesis of nanomaterials by various methods & their applications</td></tr>
<tr><td>CO 3</td><td colspan="8">Identify and understand various top-down and bottom-up approaches for nanomaterial synthesis</td></tr>
<tr><td>CO 4</td><td colspan="8">Correlate properties of nanostructures with their size, shape</td></tr>
<tr><td>CO 5</td><td colspan="8">Appreciate enhanced sensitivity of nanomaterial-based sensors and their novel applications in industry</td></tr>
</table>

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.

Course Title	**WRITE IT RIGHT**				**OPEN ELECTIVE - I**			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20OE605	**HUM**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	**--**	**--**	**3**	**40**	**60**	**100**
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hours**			

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

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Utilize effective techniques for writing job applications /course application.
CO 2	Recall the contents to make use of good paragraph writing.
CO 3	Identifying grammatical errors and can make necessary corrections.
CO 4	Demonstrate effective grammatical skills in English.
CO 5	Paraphrase a piece of writing and summarize it easily.

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="5">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

- ToenablethestudentstounderstandtheHRManagementandsystematvariouslevelsingeneralandincertainspecificindustriesororganizations.
- 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

Course Title	Concrete Technology Lab					B.Tech CE V Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2001507	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	40	60	100
Mid Exam Duration: ---						End Exam Duration: 3 Hrs		

Course Objectives:

- To achieve the practical knowledge regarding concrete testing equipment and their operation.
- To familiarize the students with physical and mechanical properties of cement concrete constituents.
- To provide practical knowledge and understanding towards the materials used for concrete.
- To acquire practical skills in the area of cement, fresh & hardened concrete testing.

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

CO 1	Conversant with ideas and concept of various properties of cement, fine aggregates & coarse aggregates.
CO 2	Appreciate importance of quality control procedures of fresh & hardened concrete with regard to their suitability in construction jobs
CO 3	Relate the efficiency of test results with regard to acceptability of these materials to be used in concrete.
CO 4	Design & describe the preparation of mix proportion of concrete and testing.
CO 5	Enable to proportion the ingredients of concrete of a given strength so as to prepare concrete to needs at site.

List of Experiments:

1. Determination of fineness & Physical properties of cement (OPC & PPC)
2. Determination of normal consistency of standard cement paste
3. Determination of specific gravity of cement (OPC & PPC)
4. Determination of initial and final setting times of cement (OPC & PPC)
5. Determination of the compressive strength of cement for OPC & PPC
6. Determination of fineness modulus of coarse and fine aggregate
7. Specific Gravity of coarse and fine aggregate
8. Determination of bulking of fine aggregate
9. Determination of workability of concrete by slump cone test & compaction factor test
10. Determination of hardened properties of concrete by compressive strength.

Augmented Experiments:

1. Flexural Strength Test of Concrete (Beam)

2. Split Tensile Strength Test of Concrete (Cylinder)

Text Books:

1. M S Shetty "Concrete Technology – Theory and Practice", S Chand & Company Limited, New Delhi.

Reference Books:

1. Hemant Sood, L N Mittal and P D Kulkarni "Laboratory Manual on Concrete Technology", C B S Publishers and Distributors, New Delhi.

<table>
<tr><td>Course Title</td><td colspan="4">Structural Analysis and Design Lab (STAAD Pro)</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">2001508</td><td rowspan="2">Professional Core (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>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">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- Learn how to achieve user specified design parameters to customize design
- Know how to perform code check, member selection and optimized member selection consisting of analysis or design cycles
- Apply the fundaments of reinforced concrete to design structures like beams, slabs, columns, retaining walls, water tanks, and other structures.

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

CO 1	Apply the core, multidisciplinary knowledge for understanding the problems in structural engineering and allied fields.
CO 2	Identify and analyse the impact of structural engineering in development projects and find a suitable solution from number of alternatives
CO 3	Demonstrate in-depth knowledge of Structural Engineering and build capability toapply that knowledge to real problems.

Exercises:

1. Analysis and design of Beam
2. Analysis and design of Column
3. Analysis and design of 2-D portal frame
4. Analysis and design of 3-D portal frame
5. Analysis and design of Two-Way Slab.
6. Analysis and design of Retaining Wall
7. Analysis and design of Water Tank
8. Analysis and design of steel tabular truss
9. Analysis and design of transmission tower
10. Earthquake load & wind load application to RC structures along with the design for different load combinations.

<u>Text Books /Reference Books:</u>

1. Dr.M.N. Sesha Prakash And Dr.C.S.Suresh,“Computer Aided Design Lab Manual” Laxmi Publications.

2. T.S. SARMA,“STAAD.PRO V8i for Beginners with indian Examples”.
3. Prof.SHAM TICKOO,“Leaning Bentley STAAD.PRO V8i for Structural Analysis”,
   Publisher : Dreamtech Press, USA.

<table>
<tr><td>Course Title</td><td colspan="5">SketchUp-3D modeling</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">20015S3</td><td rowspan="2">Skill (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>0</td><td>2</td><td>2</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 basic drawing tool to draw the building plans
• To create 3D models of building components and to prove customised outputs.</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 the SkechUp Layout and SkechUp for civil engineering drawing.</td></tr>
<tr><td>CO 2</td><td colspan="8">Create 2D and 3D models of build components</td></tr>
<tr><td>CO 3</td><td colspan="8">Use V-ray for beatification of SketchUp outputs</td></tr>
</table>

Exercises:

1. Introduction to sketchup Layout.
2. Drawing building plan using sketchup Layout.
3. Introduction to Sketchup 2D and 3D.
4. Drawing building components: doors, windows, etc.
5. Creating 3D model of a singly story building from given plan.
6. Developing interior design for a singly story building.
7. Drawing sanitary connections.
8. Basic rendering tools for V-ray.
9. Creating high-definition 2D pictures using sketchup.
10. Creating 3D motion videos using sketch.

<u>Text Books:</u>

1. Bill Fane, Mark Harrison, Josh Reilly, “SketchUp for Dummies”, For Dummies, 1st edition, 2020.
2. Michael Brightman, “The SketchUp Workflow for Architecture: Modeling Buildings, Visualizing Design, and Creating Construction Documents with SketchUp Pro and LayOut”, Wiley, 2nd edition, 2018.
3. N. Sreenivasulu, S. Rama Rao, “Civil Engineering Drawing-I”, Radiant PublishingHouse.
4. N. Sreenivasulu, “Civil Engineering Drawing-II”, Radiant Publishing House

<table>
<tr><th>Course Title</th><th colspan="5">Community Service Project</th><th colspan="3">B.Tech CE V 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">2001509</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 Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>3</td><td>100</td><td>---</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: ----</td><td colspan="3">End Exam Duration: ----</td></tr>
</table>

Course Objectives:

- To sensitize the students to the living conditions of the people who are around them
- To help students to realize the stark realities of the society
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections
- To help students to initiate developmental activities in the community in coordination with public and government authorities

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

CO 1	Positive impact on students' academic learning in view of the classroom to field and vice versa experience
CO 2	Improves students' ability to apply what they have learned in "the real world"
CO 3	Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
CO 4	Improved ability to understand complexity and ambiguity
CO 5	Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

A student may complete the Community Service Project before the beginning of 5th semester and the evaluation and credits will be awarded in 5th semester through internal assessment process only. The award of credits will be based the performance in Viva-Voce and report submitted. The duration and time frame of the Community Service Project are given below:

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.

- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. Community Awareness Campaigns (Two Weeks)
   - Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.
3. Community Immersion Programme (Four Weeks)
   - **Along with the Community Awareness Programmes**, the student batch will work along with any one of the below listed governmental agencies and do service in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics while serving the people. Programmes could be in consonance with the Govt. Departments.
4. Community Exit Report (One Week)
   - During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which shall be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

B.Tech VI SEM - CE (R20UG)

<table>
<tr><td>Course Title</td><td colspan="5">Environmental Engineering</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">2001601</td><td rowspan="2">Professional Core (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>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>
</table>

Course Objectives:

- To get the knowledge of water sources, standards, treatment of water for distribution to the domestic purpose.
- To estimate sewage and storm water from towns and to design the sewage
- To understand the design and operation of wastewater treatment units.
- To illustrate solid waste, air and noise pollutions.

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

CO 1	Know the various sources, quality standards of water.
CO 2	Acquire knowledge on different treatment methods of water.
CO 3	Plan efficient water distribution network to supply as per demand.
CO 4	Estimate the waste water quantity; collection and testing of various properties of sewage.
CO 5	Understand the various biological treatment methods of waste water treatment.

UNIT-I

Introduction, Sources & Impurities

Introduction - Water supply - Objectives of water supply systems - Water supply scheme - Quantity of water - Design period – Per Capita Consumption - Fluctuations in demand pattern - population forecast – Arithmetic, Incremental, Geometric methods.

Sources of water – Surface and Sub Surface – Quality of water - Physical, chemical and biological aspects - Impurities in water - Waterborne diseases – Drinking water quality standards.

UNIT – II

Treatment

Flowchart of water treatment plant - Treatment methods (Theory and Design) – Sedimentation - Coagulation – Filtration – slow sand, rapid sand - Disinfection – Aeration - Softening of Water – Defluoridation.

UNIT – III

Water Distributions: Requirements - Layout of Water distribution systems – Design by Hardy Cross method - Laying of pipe lines – Waste detection and prevention.

Waste water & Estimation: Definition of Terms – Sewage, Sullage, Storm Water and Sludge, Estimation of Sewage – Dry weather Flow and Wet weather flow – Average, Peak and Minimum Sewage Flows - problems.

UNIT – IV

Collection of Sewage: Separate and Combined Sewers with their Merits and Demerits – Hydraulic Design of Sewers for Full and Partial Flow System – Self Cleansing Velocity of Sewers – Sewer Appurtenances and their Location.

Characterization of Sewage: Chemical Composition of Sewage – Solids, BOD and COD, Nutrients and Biological Impurities – Numerical Problems on BOD Equation – Population Equivalent.

UNIT – V

Biological Treatment: Preliminary – Design of Screen, Grit Chamber - Primary Sedimentation Tank - Secondary – Design of Suspended and Attached Growth of Biological System – Oxidation Ponds - Tertiary treatment – Removal of Nitrogen, Phosphorus - Standards for Disposal of Treated Sewage into Inland Surface Waters, Marine Disposal and on Land for Irrigation - Design of Septic Tank and Soak Pits.

Text Books:

1. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain “Wastewater Engineering”, Lakshmi Publications, New Delhi.
2. G.S. Birdie and J. S. Birdie, “Water Supply and Sanitary Engineering”, 8th Edition, Dhanpat Rai and Sons Publishers, New Delhi, 2010.
3. K.N. Duggal, “Elements of Environmental Engineering”, 1st Edition, S.Chand Publishers, New Delhi, 2010
4. S.K. Garg, “Environmental Engineering (Vol. I): Water Supply Engineering”, 20th Revised Edition, Khanna Publishers, New Delhi, 2011

Reference Books:

1. K.N. Duggal, “Elements of environmental engineering”, S. Chand Publishers
2. H S Peavy and D R Rowe, “Environmental Engineering” Tata McGraw-Hill Companies, Inc. New York.
3. Met Calf & Eddy, “Wastewater Engineering – Treatment and Reuse”, Tata McGraw-Hill Companies, Inc. New York.
4. G.S. Birdi, Dhanpat, “Water supply and sanitary Engineering”, Rai & Sons Publishers.

<table>
<tr><th>Course Title</th><th colspan="4">Water Resources Engineering</th><th colspan="3">B.Tech CE 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">2001602</td><td rowspan="2">Professional Core (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>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>
</table>

Course Objectives:

- To study the different measures to prevent damages of Floods and their remedial measures.
- To study the various factors considering for construction of different head works
- To study the different components and their applications
- To study the various design procedures and their engineering significances
- To study the different tools required for knowing performance of water resources projects

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

CO 1	Understand different energy dissipation methods in spillways.
CO 2	Know the concepts and design principles of various types of falls in canals.
CO 3	Know the design principals of canal regulatory works.
CO 4	Identify suitable site location for various cross drainage works and their design principles.
CO 5	Know different water resources development projects across the nations and its strategies.

UNIT-I

Spillways

Types of Spillways – Necessity and Components of Spillways – Applications of Spillways – Design Principles of Ogee Spillways – Types of Spillway Gates – Energy Dissipation Methods.

UNIT – II

Canal Structures – 1

Types of Falls and Their Location – Design Principles of Sarda type Fall – Trapezoidal Notch Fall and Straight Glacis Fall.

UNIT – III

Canal Structures – 2

Canal Regulation Works – Principles of Design, Distribution, Head Regulator – Canal Outlets – Types of Canal Modules – Proportionality, Sensitivity and Flexibility.

UNIT – IV

Cross Drainage Works

Types of Selection of Site – Design Principles of Aqueduct – Siphon Aqueduct and Super Passage.

UNIT – V

Water Resources Planning

Introduction to Indian Water Resources – Scenario of Water Use – Purpose of Water Resource Development – Classification of Water Resources – Development Projects – Project Evaluation – Strategies for Future – Planning Strategies – Management Strategies.

Text Books:

1. G L Asawa "Irrigation and Water Resources Engineering", New Age International (P) Limited, Publishers, New Delhi.
2. R S Varshney, S C Gupta and R L Gupta "Theory and Design of Irrigation Structures", Nem Chand & Bros Publishers, Roorkee, Uttarakhand.
3. Loucks D.P. and van Beek E., "Water Resources Systems Planning and Management", UNESCO Publishing, The Netherlands.

Reference Books:

1. Satya Narayana Murty Challa "Water Resources Engineering – Principles and Practice", New Age International (P) Limited, Publishers, New Delhi.
2. B C Punmia, Pande B B Lal, Ashok Kumar Jain & Arun Kumar Jain "Irrigation and Water Power Engineering", Lakshmi Publications, New Delhi.
3. David A. Chin, "Water-Resources Engineering", SI Edition, Third Edition, Pearson Education, 2019.
4. Larry W. Mays, "Water Resources Engineering", Wiley, 2nd edition, 2010.

<table>
<tr><td>Course Title</td><td colspan="5">Design of Reinforced Concrete Structures</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">2001603</td><td rowspan="2">Professional Core (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>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>
</table>

Course Objectives:

- To define and introduce the different design philosophies of Reinforced Cement Concrete.
- To implement the Limit State Method for design of rectangular section beams.
- To design two way slabs and dog-legged staircase
- To design the short and long columns for axial load, uniaxial and by-axial bending conditions
- To Design the isolated and combined footings.

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

CO 1	Know the various design philosophies and analyse the rectangular beam section using Limit State Method.
CO 2	Design the beam for flexural, shear and torsional loading conditions.
CO 3	Design the RCC slabs with different support conditions and staircases.
CO 4	Design the RCC columns for different loading conditions.
CO 5	Design isolated and combined footing for given SBC.

UNIT-I

Introduction

Introduction to working stress and limit state methods-characteristic values & partial safety factors, Stress-strain curves for concrete & steel. Limit State Method: Stress Block Parameters as per IS 456 -2000, Under reinforced-over reinforced-balanced sections, analysis of rectangular section beams using limit state methods.

UNIT – II

Limit State Design for Flexure, Shear, Torsion and Bond

Design of singly & double reinforced rectangular beams for flexure. Design of rectangular sections for shear and torsion. Design for Bond –Anchorage and Development length of bars

UNIT – III

Design of Slabs and Staircase

Design of two way slabs with different end conditions (IS Code Method). Design of dog-legged staircase.

UNIT – IV

Design of Compression Members

Short Column - Columns with axial loads, uni-axial and bi-axial bending – Use of design charts- Long column – Design of long columns - IS Code provisions

UNIT – V

Design of Foundation

Different types of footings –Design of flat isolated square, rectangular, circular footings and combined footings for two columns.

Text Books:

1. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain "Comprehensive RCC Design", Laxmi Publications, New Delhi.
2. N. Subramanian, "Design of Reinforced Concrete Structures", Oxford University Press
3. S. Unnikrishna Pillai & Devdas Menon, Reinforced Concrete Design, TMH, New Delhi. 3rd Edition 2009
4. M.L. Gambhir, "Fundamentals of Reinforced concrete design", PHI, New Delhi.2^{nd} Edition 2010

Reference Books:

1. Ashok. K Jain "Reinforced Concrete: Limit State Design", Nem Chand & Bros, Roorkee.
2. N Krishna Raju and R N Pranesh "Reinforced Concrete Design: IS: 456-2000 Principles and Practice", New Age International (P) Limited, Publishers, New Delhi.
3. P.C. Varghese, "Limit state designed of reinforced concrete", PHI Learning Pvt. Ltd.
4. N.C. Sinha and S.K Roy, "Fundamentals of Reinforced Concrete", 4th Edition, S. Chand publishers, 2004.

<table>
<tr><td>Course Title</td><td colspan="4">Pre-Stressed Concrete</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">2001604</td><td rowspan="2">Professional Elective (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>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 give idea on methods available on pre-stressed concrete and analysis of pre-stressed members and design of members.</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	Classify and differentiate the design principles of pre-stressed concrete over reinforced concrete and its advantages and limitations.
CO 2	Identify the losses in pre-stressed members due to short and long term deformations.
CO 3	Design the pre-stressed concrete beams for flexure as per codal recommendations.
CO 4	Design the pre-stressed concrete beams for shear as per codal recommendations.
CO 5	Identify the factors influencing deflections and design of pre-stressed beams under deflection criteria.

UNIT-I

Introduction: General Principles of Pre-Stressed Concrete Members – Advantages and Limitations of Pre-Stressed Concrete – Comparison of Pre-Stressed Concrete Beams with Reinforced Concrete Beams.

Systems of Pre-Stressing: Classification of Pre-Stressed Concrete Members, System of Pre-Stressing, Pre-Tensioned System, Stability of the System. Hoyer System, Magnel Blaton System, Freyssinet System, Gifford Udall System, P.S.C Mono Wire System, C.C.L Standard System, LEE-MCCALL System.

UNIT – II

Losses of Pre-Stresses: Loss of Pre-Stress in Pre-Tensioned and Post-Tensioned due to Various Causes Like Elastic Shortening of Concrete, Shrinkage of Concrete, Creep of Concrete, Relaxation of Stress in Steel, Slip in Anchorage Bending of Member and Wobble Frictional Losses.

UNIT – III

Analysis and design of sections for flexure: Assumptions, Analysis by Stress Concept – Elastic Analysis of Concrete Beams Pre-Stressed with Straight, Concentric, Eccentric, Bent and Parabolic Tendons – Design of Pre-Stressed Concrete Beams – I.S Recommendations as per IS 1343 Code Book – Design of Rectangular and an I-Section of a Beam – Lever Arm Concept – Kern Distance.

UNIT – IV

Shear Design of PSC Beam: Design of Shear based on IS 1343 Code Book – Design of Beam.

UNIT – V

Deflections of Pre-Stressed Concrete Beams: Importance of Control of Deflections – Factors Influencing Deflections – Short Term Deflections of Uncracked Members Prediction of Long Term Deflections.

Text Books:

1. S Ramamrutham, "Pre-Stressed Concrete", Dhanpat Rai Publishing Company (P) Limited, New Delhi.
2. N Krishna Raju, "Pre-Stressed Concrete", Tata McGraw-Hill Companies, Inc. New York.
3. N Rajagopalan, "Pre-Stressed Concrete", Narosa Publishing House, New Delhi.
4. M.K.Hurst, "Prestressed Concrete Structures", Tata Mc.Graw Hill Publications, 2nd Edition,2009.

Reference Books:

1. IS 1343-2012 "Indian Standard Code of Practice for Prestressed Concrete", Bureau of Indian Standards, New Delhi.
2. P.Dayaratnam, "Pre-stressed Concrete Structures", Oxford &IBH Publishers, Fourth Edition.
3. K. U. Muthu, Agmil Ibrahim, Maganti Janardhana, M. Vijayanand, "Pre-stressed Concrete", PHI Publishers, 2016
4. T.Y. Lin & N.H. Burns, "Design of Pre-Stressed Concrete Structures", John Wiley & Sons, 3rd Edition, 2005.

<table>
<tr><th>Course Title</th><th colspan="5">Bridge Engineering</th><th colspan="3">B.Tech CE 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">2001605</td><td rowspan="2">Professional Elective (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>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>
</table>

Course Objectives:

- To acquire knowledge about bridges and its components, different types of loading s and IRC classification of loading and its importance.
- To understand about analysis and design about square box culvert.
- To make the students able to analyze deck slab bridges and its importance.
- To give knowledge about analysis and design of T-beam bridges and various types of class ‘AA’ loadings acting on T-beam bridges.
- To understand about piers, abutments, various forces acting on piers & abutments. And also design principles of various bridge bearings.

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

CO 1	Know the site selection parameters and various loads on bridge structures.
CO 2	Analyse & Design of box culvert under classified loads.
CO 3	Analyse and Design deck slab bridge according to IRC codes
CO 4	Analyse & Design of T-beam bridge subjected to class ‘AA’ tracked vehicles loading conditions.
CO 5	Understand the design principles and learn stability aspects of piers, abutments and bridge bearings.

UNIT-I

Introduction

Importance of Site Investigation in Bridge Design – Highway Bridge Loading Standards – Impact Factor – Railway Bridge Loading Standards (B.G & M G Bridges) – Various Loads in Bridges.

UNIT – II

Design of Box Culvert

General Aspects – Design Loads – Design of Box Culvert Subjected to R C Class AA Tracked Vehicles only.

UNIT – III

Design of Deck Slab Bridge

General Features – Effective Width Method of Analysis; Design of Deck Slab Bridge (Simply Supported) subjected to Class AA Tracked Vehicles only.

UNIT – IV

Design of T-Beam Bridge

General Features – Design of Interior Panel of Slab – Pigeaud's Method – Design of a T- Beam Bridge Subjected to Class AA Tracked Vehicles only.

UNIT – V

Piers, Abutments and Bridge Bearings

General Features – Bed Block – Material Piers & Abutments – Types of Piers – Forces Acting on the Piers – Stability Analysis of Piers – General Features of Abutments – Forces Acting on Abutments – Stability Analysis of Abutments – Types of Wing Walls – Approaches – Types of Bridge Foundations (Excluding Design)

Bridge Bearings

General Features – Types of Bearings – Design Principles of Rocker & Roller Bearings – Design of Steel Rocker Bearings – Design of Elastomeric Pad Bearings

Text Books:

1. S Ponnuswamy, "Bridge Engineering", Tata McGraw-Hill Companies, Inc. New York.
2. N Krishna Raju, "Design of Bridges", Oxford & IBH Publishing Company (P) Limited, New Delhi.
3. V.N. Vazirani and M.M. Ratwani M.G. Aswani, "Design of Concrete Bridges", Khanna Publishers, 1995.
4. B.C. Pumai, Jain & Jain, "Design of RC Structures", Lakshmi Publications.

Reference Books:

1. IS 800-2007 "Indian Standard Code of Practice for General Construction in Steel", Bureau of Indian Standards, New Delhi.
2. IS 456-2000 "Indian Standard Plain and Reinforced Concrete – Code of Practice", Bureau of Indian Standards, New Delhi.

3. IRC 6-2000 “Standard Specifications and Code of Practice for Different Types of Loadings Acting on the Bridge Structure”, The Indian Roads Congress, New Delhi.
4. IRC 22-2000 “Standard Specifications and Code of Practice for Road Bridges and Different Materials used in Bridge Structures and Reinforcement Details”, The Indian Road Congress, New Delhi.
5. IRC 24-2000 “Standard Specifications and Code of Practice for Permissible Bending Stresses in Steel and its Properties”, The Indian Road Congress, New Delhi.
6. IRC 83-2000 “Standard Specifications and Code of Practice for Different Types of Bridge Bearings used in the Bridges and its Detailed Specifications”, The Indian Road Congress, New Delhi.

<table>
<tr><td>Course Title</td><td colspan="4">Traffic Engineering</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">2001606</td><td rowspan="2">Professional Elective (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>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>
</table>

Course Objectives: To set a solid and firm foundation in

- Traffic engineering management.
- Traffic regulation means and measures.
- Concept of highway capacity.
- Road safety
- Concepts of traffic flow theory

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

CO 1	Justify the need for traffic management.
CO 2	Implement different traffic regulations.
CO 3	Apply highway capacity concept for designing and evaluating various traffic management means and measures.
CO 4	Design and implement various road safety enhancement measures.
CO 5	Interpret, analyse data for simple situations to predict the main characteristics of traffic flow.

UNIT-I

Traffic Management

Traffic management – scope of traffic management measures – restrictions to turning movements – one-way streets – tidal flow operations-Traffic segregation –Traffic calming- Exclusive bus lanes, Introduction to ITS

UNIT – II

Traffic Regulation

Regulation of traffic – Need and scope of traffic regulations- Motor Vehicle Act – Speed limit at different locations- regulation of the vehicle – regulations concerning the driver rules of the road enforcement

UNIT – III

Highway Capacity

Highway capacity: Its importance in transportation studies – basic, possible and practical capacity – determination of theoretical maximum capacity -passenger car units – level of service – concept in HC manual – factors affecting level of service.

UNIT – IV

Traffic Safety

Road Accidents-Causes and Prevention-Road and its effect on accidents-The Vehicle-The Driver-Weather and its effect on accidents-Speed in Relation of Safety-Collection of accident data-Condition Diagram and Collision Diagram-Traffic Management Measures and their Influence on Accident Prevention.

UNIT – V

Traffic Flow

Theory of traffic flow – scope – definition and basic diagrams of traffic flow- basic concepts of light hill – Whitham's theory – Introduction to Car 'following theory and queuing'.

Text Books:

1. Khanna, S.K. and C.E.G. Justo, C.E.G., "Highway Engineering", Khanna Publishers, Roorkee, 2001.
2. Kadiyali, L.R., "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi
3. Donald Drew, Traffic Flow Theory Chapter 14 in Differential Equation Models, Springer, 1983
4. Papa Costas C.S., "Fundamentals of Transportation Engineering", Prentice Hall, India

Reference Books:

1. Martin Whol & Brian V Martin, "Traffic system Analysis for Engineers and Planners", McGraw Hill, NY, 1967.
2. Highway Capacity Manual: HCM 2010 (3 volume set), TRB Publications, 2010
3. Jotin Khisty, C. and Kent Lall, B., "Transportation Engineering – An Introduction", Prentice-Hall.
4. Salter, R.J. and Hovnsell, N.B., "Highway Traffic Analysis and Design", 3rd Edition, Macmillan Press Ltd, 1996.

<table>
<tr><td>Course Title</td><td colspan="5">HUMAN RESOURCE DEVELOPMENT (Humanities Open Elective)</td><td colspan="3">B.Tech. VI Sem
ECE, CE, -VI Sem
ME, CSE, AI & ML, EEE – 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">2006601/ 2006701</td><td rowspan="2">Humanities & Social Sciences (HSMC)</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">External Exam Duration: 3Hrs</td></tr>
</table>

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 De Simone: Human Resource development (Thomson/Cengage)
2. Raymond A Noe: Employee Trainee Development (Tata McGraw Hill)
3. Dr. D.K Bhattacharya, Himalaya Publishing House

References:

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)

Course Title	Digital Marketing (Humanities Open Elective)					B.Tech. VI Sem ECE, CE, -VI Sem ME, CSE, AI & ML, EEE – VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2006602/ 2006702	**Humanities & Social Sciences (HSMC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 2Hrs						**External Exam Duration: 3Hrs**		

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

Course Outcomes: On success Completion This course, the students will be able to

CO1	**Analyze** the confluence of marketing, operations, and human resources in real-time delivery.
CO2	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.
CO3	Explain emerging trends in digital marketing and critically assess the use of digital marketing tools by applying relevant marketing theories and frameworks.
CO4	Investigate and evaluate issues in adapting to globalized markets that are constantly changing and increasingly networked.
CO5	Interpret the traditional marketing mix within the context of a changing and extended range of digital strategies and tactics.

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 Antorny Puthussery

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.

<table>
<tr><td>Course Title</td><td colspan="5">Project Management
(Humanities Open Elective)</td><td colspan="3">B.Tech. VI Sem
ECE, CE, -VI Sem
ME, CSE, AI & ML, EEE – 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">2006603/
2006703</td><td rowspan="2">Humanities & Social Sciences (HSMC)</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">External Exam Duration: 3Hrs</td></tr>
</table>

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 Value Engineering: 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. Prasanna Chandra, Projects, Tata Mc Graw Hill.
5. Nagarajan K, Project Management 4th edition, New Age International(P)Ltd.
6. L S Srinath, 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 Sitangshu Khatua; published by Oxford University.
4. Nicholas J.M. &Steyn H, Project Management, Elsevier, Himalaya publications.
5. Narendra Singh, Project Management and Control, HPH,2003.
6. Harvey Maylor, Project Management, Pearson Education.
7. Panneer selvam Senthil kumar, Project Management, PHI.

<table>
<tr><td>Course Title</td><td colspan="5">Constitution of India
(Mandatory Course)</td><td colspan="3">B.Tech. V Sem
ME, CSE & EEE-V Sem
CE & ECE- 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">20MC509/
20MC609</td><td rowspan="2">Humanities & Social Sciences (HSMC)</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>2</td><td>0</td><td>0</td><td>0</td><td>40</td><td>00</td><td>40</td></tr>
<tr><td colspan="6">Mid Exam Duration: 2Hrs</td><td colspan="3">External Exam Duration: –</td></tr>
</table>

CourseObjectives: 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.

CourseOutcomes:Onsuccess Completion Thiscourse,thestudentswillbeableto

CO1	Describe the historical background of the constitution making and its importance for building a democratic India.
CO2	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary.
CO3	Explain the value of the fundamental rights and duties for becoming good citizen of India.
CO4	Analyze the decentralization of power between central, state and local self government.
CO5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

Unit - 1:
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 - 2:
Union Government and its Administration Structure of the Indian Union: Center- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet a

nd Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions.

Unit - 3:

State Government and its Administration Governor – Role and Position – CM and Council of ministers, State Secretariat: Organization, Structure and Functions.

Unit - 4:

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 - 5:

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.

Textbooks

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:

- Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
- Subhash Kashyap, Indian Constitution, National Book Trust
- J.A. Siwach, Dynamics of Indian Government & Politics
- D.C. Gupta, Indian Government and Politics
- H.M.Seervai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

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

<table>
<tr><td>Course Title</td><td colspan="5">Environmental Engineering Lab</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">2001607</td><td rowspan="2">Professional Core (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>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">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- To analyze the Waste water sources and waste water characteristics.
- To Compare the results on estimating various parameters like pH, Chlorides, and different solids in water.
- Status of Industrial effluents will also be taught in the laboratory by estimating BOD and COD of effluent.

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

CO 1	Describe the knowledge of physical, chemical and biological parameters of water and their importance.
CO 2	Understand and use the domestic water sampling procedures and sample preservations.
CO 3	Apply the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions.
CO 4	Understand and use wastewater sampling procedures and sample preservations.
CO 5	Understand and apply ethical issues associated with decision making and professional conduct in the laboratory and field environment.

List of Experiments:

1. Determination of various forms of Acidity
2. Determination of various forms of Alkalinity
3. Determination of pH in water
4. Determination of Chlorides content
5. Determination of Residual Chlorine
6. Determination of Turbidity in water
7. Determination of various forms of Solids
8. Determination of Hardness in water
9. Determination of Dissolved oxygen
10. Determination of Optimum Dosage of Coagulant

Augmented Experiments:

1. Determination of total iron in the water
2. Determination of fluoride in water

Text Books:

1. Dr. G Kotaiah and Dr. N Kumara Swamy "Environmental Engineering Lab Manual",Charotar Publishing House, Anand, Gujrat.
2. S.K. Garg, "Environmental Engineering (Vol.I): Water Supply Engineering", 20thRevisedEdition, Khanna Publishers, New Delhi, 2011.

Reference Books:

1. Clair N Sawyer, Perry L Mccarty and Gene F Parkin "Chemistry for EnvironmentalEngineering and Science", Tata McGraw-Hill Edition, New Delhi.
2. CPHEEO, Ministry of Urban Development (1996), Manual on water supply and Treatment, New Delhi.

<table>
<tr><td>Course Title</td><td colspan="4">Computer-Aided Design and Drafting Lab</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">2001608</td><td rowspan="2">Professional Core (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>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">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- To know how to apply engineering drawing using computers
- To make the student to understand about the scope of Auto CAD software
- To teach detailing of different reinforced cement concrete components.

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

CO 1	Understand the process of detailing different building components.
CO 2	Apply AutoCAD tool for drawing and detail of civil engineering components.
CO 3	Provide proper detailing drawing to customer.

Exercises:

1. Detailing of Reinforced Cement Concrete determinate beams.
2. Detailing of Continuous and indeterminate Reinforced Cement Concrete beams.
3. Detailing of circular and rectangular Columns.
4. Details of one-way and two-way slabs.
5. Detailing of Reinforced Concrete wall.
6. Detailing of Earth retaining structures
7. Detailing of rectangular and circular footing.
8. Detailing of different combined footings.
9. Detailing of different deep foundations.
10. Detailing of Over Head Water Tank.

Text Books:

1. N. Sreenivasulu, S. Rama Rao, "Civil Engineering Drawing-I", Radiant Publishing House.
2. N. Sreenivasulu, "Civil Engineering Drawing-II", Radiant Publishing House.
3. G C Sahu, Joy Gopal Jena, "Building Materials and Construction", McGraw hill Pvt Ltd 2015
4. Duggal, "Building Materials", New Age International

Reference Books:

1. P. J. Sha, "Engineering Graphics", S. Chand & Co.
2. S. Mahaboob Basha, "Civil Engineering Drawing-I", Falcon Publishers
3. M. G. Shah,"Building drawing", Tata McGraw-Hill Education.
4. R. Chubby,"Construction Technology – Vol – I & II", Longman UK

<table>
<tr><th>Course Title</th><th colspan="5">Advanced Concrete Technology Lab</th><th colspan="3">B.Tech CE 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">2001609</td><td rowspan="2">Professional Core (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>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">Mid Exam Duration: ---</td><td colspan="3">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- To conduct laboratory tests to find the suitability of the design of concrete mixes

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

CO 1	The behavior of fresh concrete with advanced methods.
CO 2	Find out the crushing strength of hardened concrete and its crack pattern during the testing.
CO 3	The behavior of concrete against severe exposure conditions.
CO 4	Understand the effect of Chemicals on the properties of concrete.

<u>List of Experiments:</u>

1. Determination of workability of concrete by Vee-bee Consistometer test.
2. Determination workability of concrete by Flow table test.
3. Determine Young's Modulus of concrete and draw the graph.
4. Determine Compressive strength of the concrete using Non-Destructive testing by Rebound Hammer.
5. Determination of Rapid chloride permeability Number by using RCPT as a durability parameter.
6. Determine Compressive strength of concrete in Acid Curing and Compare its strength with Conventional concrete
7. Determine of Compressive strength of concrete in Sulphate solution curing and compare its strength with Conventional concrete.
8. Determination of carbonation depth of concrete.
9. Determine the behaviour of beams under shear.

<u>Text Books:</u>

1. M S Shetty "Concrete Technology – Theory and Practice", S Chand & Company Limited, New Delhi.

Reference Books:

1. Hemant Sood, L N Mittal and P D Kulkarni "Laboratory Manual on Concrete Technology", C B S Publishers and Distributors, New Delhi.

B.Tech VII SEM CE (R20)

<table>
<tr><td>Course Title</td><td colspan="4">Ground Improvement Techniques</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">2001701</td><td rowspan="2">Professional Elective (PEC 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 learn and understand various ground improvement technique.
• To learn various method of compaction for ground improvement in its strength.
• To learn various physical and chemical modification for ground improvement
• To learn the method to choose the foundation and or treatment method based on the site condition</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	Select the ground improvement technique which is suitable and economical for soil strengthening.
CO 2	Select different techniques based on the various types of soils in-situ
CO 3	Design reinforced earth structures
CO 4	Exposed to the knowledge on use of geosynthetic material
CO5	Understand the behavior of expansive soils and design foundations in expansive soils

UNIT-I

Introduction

Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique; objectives of improving soil.

Stabilisation

Methods of stabilization-mechanical-cement- lime bituminous- chemical stabilization with calcium chloride, sodium silicate and gypsum.

UNIT-II

Densification Methods in Granular Soils

In – situ densification methods in granular Soils – Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth.

Densification Methods in Cohesive Soils

In-situ densification methods in cohesive soils – preloading or dewatering, vertical drains – Sand Drains, Sand wick geodrains – Stone and lime columns – thermal methods.

UNIT-III

Dewatering

Methods of de-watering- sumps and interceptor ditches- single, multi stage well points - vacuum well points- Horizontal wells-foundation drains-blanket drains- criteria for selection of fill material around drains –Electro-osmosis.

Grouting

Objectives of grouting- grouts and their properties-grouting methods- ascending, descending and stage grouting- hydraulic fracturing in soils and rocks- post grout test.

UNIT-IV

Reinforced Earth

Principles – Components of reinforced earth – factors governing design of reinforced earth walls – design principles of reinforced earth walls.

UNIT-V

Expansive Soils

Problems of expansive soils – tests for identification – methods of determination of swell pressure. Improvement of expansive soils – Foundation techniques in expansive soils – under reamed piles

Text Books:

1. Dr. P. Purushothama Raj., “Ground Improvement Techniques”, Lakshmi Publications Pvt. Ltd.
2. Jones, J.E.P., Earth Reinforcement and Soil Structure, Butterworths, 1985.
3. Koerner, R.M. and Welsh, J.P., Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.
4. Koerner, R.M., Designing with Geosynthetics (Third Edition), Prentice Hall, 1997.

Reference Books:

1. Moseley, M.D., Ground Treatment, Blackie Academic and Professional, 1998.
2. Hehn, R.W., Practical Guide to Grouting of Underground Structures, ASCE, 1996.
3. Das, B.M., Principles of Foundation Engineering, (Fourth Edition). PWS Publishing, 1999

<table>
<tr><td>Course Title</td><td colspan="5">Quantity Estimation of Structures</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">2001702</td><td rowspan="2">Professional Elective (PEC 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>
</table>

Course Objectives:

- To impart basic knowledge on Estimation of structures and understand how to Estimate the quantities of engineering projects
- To know the importance of specifications in final cost of the structure.
- To understand how to prepare the rate of the different item of works with SSR and Data book
- To understand the contractual system in public works and know the importance of Valuation
- To gain basic knowledge on quantity estimation of other Civil Engg Structures

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

CO 1	Acquire knowledge on specifications of different items of work related to build construction.
CO 2	Estimated different items of works and prepare bar bending schedule.
CO 3	Do rate analysis of varies items of works as per Standard Schedule of Rates.
CO 4	Understand the different types of contracts and valuation methods.
CO 5	Estimate various items of works related to irrigation and road structures.

UNIT-I

Introduction to The Estimation

Importance of Estimation for Structures, units and items of works in structures, Methods of Estimation, Quantity Estimation of Single Room, Double Room and Multiple Rooms with Long wall and Short wall methods and Framed Structures.

Estimation of Bar Bending Schedule : Beams, columns, Slabs, Staircases, Sun shade, Lintels.

UNIT – II

Specifications of Different Item of Works

Specification of different items of works: Earth work for foundations, mortars, Plain cement concrete, Reinforced concrete roofing, Brick work, Stone masonry, RCC roof and AC roof and GI sheet roof structures, plastering, Painting, pointing and wood works.

UNIT – III

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, cement concrete flooring with 1:2:4 mix, Ceramic and Vitrified Tile flooring.

UNIT – IV

Contracts and Valuation

Contracts: Types of contracts, contract document, conditions of contracts, contract procedure, termination of contracts, arbitration and tenders.

Valuation: Introduction, Technique of valuation, elements of valuation and factors affecting valuation, methods of valuation.

UNIT – V

Estimation of Irrigation and Road Structures

Estimate of bituminous and cement concrete roads, estimate of retaining walls, Estimation of Canals Dam structures

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

Reference Books:

1. S C Rangwala "Estimating Costing and Valuation", Charotar Publishing House Pvt. Limited, Anand.

2. M. Chakraborthi, Estimating Costing Specification and Valuation in Civil Engineering,23rd Edition, Laxmi Publications, New Delhi, 2010.

Course Title	Finite Element Method	B.Tech CE VII Sem (R20)

<table>
<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">2001703</td><td rowspan="2">Professional Elective (PEC 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 understand the concepts of Finite element methods to analyze critical stress conditions instructures.</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 the Finite Element Methods.</td></tr>
<tr><td>CO 2</td><td colspan="8">Derive Finite Element Formulation for one dimensional beam and bar elements.</td></tr>
<tr><td>CO 3</td><td colspan="8">Apply two dimensional elements for analysis of structures.</td></tr>
<tr><td>CO 4</td><td colspan="8">Understand isoperimetric elements and its applications in Finite Element Methods.</td></tr>
<tr><td>CO 5</td><td colspan="8">Analyse various structures for static loading conditions using Finite Element Methods.</td></tr>
</table>

<u>UNIT - I</u>

Introduction to Finite Element Method

Basic Concepts of FEM, Limitations, Finite Element Modelling and Discretization, Types of Elements, Nodes and Degrees of Freedom, Interpolation and ShapeFunctions

<u>UNIT– II</u>

One Dimensional

Local and Global coordinate systems - Finite element modelling - Stiffness matrix for Bar element, Flexure element - Element load vector - Equivalent nodal loads.

TRUSSES: Plane Trusses - Local and Global Coordinate Systems - Direction Cosines - ElementStiffness Matrix - Assembly of Global Stiffness Matrix - Stress Calculation.

<u>UNIT – III</u>

Two-Dimensional Elements

Two Dimensional Elements- Different types of elements for plane stress and plane strain analysis – Displacement models– generalized coordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates.

<u>UNIT - IV</u>

Iso-Parametric Elements and Finite Element Modelling

Mesh Requirements - Material Properties - Loads and Reactions - Boundary Conditions - Checking the Model - Analysis andDesign Software (For Practice Purpose Only)

UNIT - V

Solution Techniques

Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

Applications of FEM

Plate bending problems - Finite elements in Fluid mechanics – Finite elements to elastic stability

Text Books:

1. Daryl L Logan “A First Course in the Finite Element Method”, Cengage Learning India Private Limited, New Delhi.

2. S S Bhavikatti “Finite Element Analysis”, New Age International (P) Limited, Publishers, New Delhi.

3. Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers

4. Finite element analysis by S.S. Bhavakatti-New age international publishers

Reference books:

1. Robert D Cook, David S Malkus and Michael E Plesha “Concepts and Applications of Finite Element Analysis”, Wiley India Pvt. Limited, New Delhi.

2. George R Buchanan “Theory and Problems of Finite Element Analysis”, Tata McGraw-Hill Companies, Inc. New York.

3. Finite element analysis and procedures in engineering by H.V.Lakshminaryana, 3rd edition, universities press, Hyderabad.

4. Finite Element Analysis for Engineering and Technology, Tirupathi R Chandraputla, Universities Press Pvt Ltd, Hyderabad. 2003.

<table>
<tr><td>Course Title</td><td colspan="5">Design of Steel Structures</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">2001704</td><td rowspan="2">Professional Elective (PEC 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>
</table>

Course Objectives:

- The student acquires knowledge about elastic & plastic methods to analyze the structural elements.
- To understand about different types of tension & compression members and to analyze easily by limit state design.
- To make the student able to analyze various beams like laterally supported & laterally unsupported beams.
- To make the students to understand the beam to beam & beam to column connections.
- To understand the design of slab base and gusseted based and subjected to moments.

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

CO 1	Aware of standard loads and load combinations considered for design of steel structures; basic knowledge on plastic analysis.
CO 2	Analyse and design welded connections subjected to axial loads and moments.
CO 3	Deign tension and compression members with different cross-sections.
CO 4	Design simple and compound beams and beam connections.
CO 5	Design beam column connections and column base.

UNIT – I

Introduction: Loads & Load combinations: Appraisal of loading standards such as I.S, I.R.C Effect of wind and earthquake on structure.

Plastic Analysis : Introduction – Idealized Stress – Strain Diagram – Shape Factors for Various Sections – Moment Curvature Relationship – Ultimate Moment – Plastic Hinge – Lower and Upper Bound Theorems – Ultimate Strength Fixed and Continuous Beams – Frames.

UNIT – II

Welded Connections: Introduction – Advantages and Disadvantages of Welding – Strength of Welds – Butt and Fillet Welds – Permissible Stresses – IS Code Requirements – Design of Welds Subjected to Moment Acting in the Plane and at Right Angles to the Plane of the Joints – Beam to Beam and Beam to Column Connections.

UNIT – III

Design of Tension Members: Types of Sections – Net Effective Section for Angles and Ties in Tensions - Lug Angles – Tension Splices.

Design of Compression Members: Plain and Built-Up Compression Members – Assumptions Regarding End Conditions – Design of Built-Up Columns with Battens and Lacings – Splicing of Column.

UNIT – IV

Design of Beams: Allowable Stresses – Design Requirements as per IS Code – Design of Simple and Compound Beams- Curtailment of Flange Plates – Beam to Beam Connections – Check for Deflections –Shear – Buckling – Check for Bearing – Laterally Unsupported Beams.

UNIT – V

Design of Beam to Column Connections: Introduction – Design of Beam to Column Connections – Framed, Stiffened, Un-Stiffened and Seated Bracket Connections. Design of Column Bases: Design of Slab Base and Gusseted Bases – Column Bases subjected to Moment.

Text books:

1. S K Duggal "Limit State Design of Steel Structures", Tata McGraw-Hill Companies, Inc. NewYork.

2. S S Bhavikatti "Design of Steel Structures", I K International Publishing House Pvt. Limited, New Delhi.

3. Design of steel structures by M Raghupathi Tata MC Graw –Hill

4. Steel structures by Subramanian N, Oxford Higher Education, New Delhi

Reference Books / Is Codes / Tables:

1. IS 800 – 2007 "Indian Standard Code of Practice for General Construction in Steel", Bureau of Indian Standards, New Delhi.

2. IS 875 – Part – 3 "Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Building and Structures – Wind Loads", Bureau of Indian Standards, NewDelhi.

3. K L V Ramu and Subhash Chander "Steel Tables – SI Units", Jain Brothers, New Delhi.

4. Limit state Design of steel structures by S.K. Duggal Tata MCgraw Hill, New Delhi

Course Title	**Water Supply Engineering**					**B.Tech CE VII Sem (R20)**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2001705	**Professional Elective (PEC 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:

- To import knowledge in water quantity and quality parameters and future demandand forecasts on water
- To study the sources, quality, and standards of water
- To understand various water treatments methods
- To understand the water distribution system from source to destination

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

CO 1	Estimate per capita consumption of water for future demands using different methods.
CO 2	Know various sources of water and quality standards of drinking water.
CO 3	Understand the stages involved in drinking water treatment process.
CO 4	Follow advanced water treatment methods adopted by industry and sustainable water management methods.
CO 5	Plan efficient water distribution network to supply as per demand.

UNIT - I

Introduction

Role of Environmental Engineer - Development of public water supply - Need for protected water supply - Objectives of water supply systems - Per Capita Consumption - Water quantity estimation - population forecast - Arithmetic, Incremental, Geometric methods.

UNIT - II

Sources of Water

Sources of water - Surface and ground water sources – Infiltration galleries - Infiltration wells.

Quality of Water

Quality of water - Physical, chemical, and biological aspects - Drinking water quality standards - Water borne diseases.

UNIT - III

Treatment of Water

Flow chart of water treatment plant – Treatment - Sedimentation - Coagulation - Filtration - Disinfection methods - Softening of Water – Defluoridation.

UNIT - IV

Advanced Water Treatments

Objectives and types of Aeration - Iron and manganese removal - Demineralization - Desalination - Membrane Systems.

Water Management

Sustainable Development - Rainwater harvesting methods - Water Pollution - Causes and effects

UNIT - V

Water Distributions

Distribution systems - Requirements, Layout of Water distribution systems - Design procedures - Hardy Cross methods - Laying of pipelines - waste detection and prevention - Different types of valves Joints, and fire hydrants.

Text Books:

1. S K Garg, “Environmental Engineering”, Vol.1 Khanna Publishers, New Delhi.
2. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain “Water Supply Engineering”, LakshmiPublications, New Delhi.
3. Water supply and sanitary Engineering by G.S. Birdi, Dhanpat Rai & Sons Publishers
4. Water Supply Engineering, Vol. 1, waste water Engineering, Vol. II, B.C.Punmia, AshokJain & Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi

Reference Books:

1. H S Peavy, D R Rowe and G Tehobanoglous “Environmental Engineering” Tata McGraw-Hill Companies, Inc. New York.
2. S K Hussain “Water Supply and Sanitary Engineering”, Oxford & IBH, New Delhi.
3. K.N. Duggal, Elements of Environmental Engineering, 1st Edition, S.Chand Publishers,New Delhi, 2010.
4. G.S. Birdie and J. S. Birdie, Water Supply and Sanitary Engineering, 8th Edition, DhanpatRai and Sons Publishers, New Delhi, 2010.

Course Title	Advanced Concrete Structures	B.Tech CE VII Sem (R20)

Text Books:

<table>
<tr><th rowspan="3">Course Code</th><th rowspan="3">Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>Continuous Internal Assessment</th><th>End Exam</th><th>Total</th></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>2001706</td><td>Professional Elective (PEC-IV)</td><td colspan="7"></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 expose students to the design and analysis methodology for designing combined footings, retaining walls, overhead tanks, bridge deck slabs as per standard IS and IRC codal provisions.</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 combined footings as per limit state design method of IS 456-2000 codal provisions</td></tr>
<tr><td>CO 2</td><td colspan="8">Design & detailing of cantilever and counterfort retaining walls as per IS Codal Provisions</td></tr>
<tr><td>CO 3</td><td colspan="8">Design RCC circular ground level and over-head tanks as per IS code</td></tr>
<tr><td>CO 4</td><td colspan="8">Design RCC flat slabs as per IS code</td></tr>
<tr><td>CO 5</td><td colspan="8">Design RCC bridge deck slab as per IRC codal provisions</td></tr>
</table>

UNIT – I

Combined Footings

Limit state design & detailing of combined- rectangular and trapezoidal footings as per IS: 456-2000 Codal Provisions.

UNIT – II

Design & detailing of cantilever and counter-fort Retaining wall as per IS Codal Provisions.

UNIT – III

Elastic Design & Detailing for RCC circular and Rectangular ground level and over-head tanks- Design of staging, Design of Intze tanks as per IS Codal Provisions.

UNIT – IV

Design of Flat slab (Interior panel only)

UNIT – V

Elastic design and detailing of RC bridge deck slab using effective width method and Pigeaud's method as per IRC Codal Provisions.

Text Books:

1. S. Ramanatham, Design of Reinforced Concrete Structures, Dhanpat Rai &Sons, 2002.
2. D.S. Prakash Rao; Design Principles and Detailing of Concrete Structures, Tata McGraw-Hill Publishing Co. Ltd., 1995.
3. Johnson Victor, D., “Essentials of Bridge Engineering”, Oxford & IBH Publishing Co., New Delhi, Fourth Edition, 1991
4. Krishna Raju. N., “Advanced Reinforced Concrete Design”, CBS Publishers anddistributors, 2007
5. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, Tata McGraw HillPublishers Company Ltd., New Delhi, 2006.

Reference Books:

1. Park & Paulay , “Reinforced Concrete”, Robert Publisher,1975.
2. Ashok.K. Jain, Nem Chand & Bors. “Reinforced Concrete”, Tata McGraw-Hill PublishingCompany Limited, New. Delhi, 2003.
3. Sinha. N. C. and Roy S. K., “Fundamentals of Reinforced Concrete”, S. Chand andcompany Limited, New Delhi, 2003.
4. Bungey, Millard, Grantham, “Testing of Concrete in Structures”, Taylor and Francis,United Kingdom.
5. IS 456:2000 Plain and Reinforced Concrete - Code of Practice.

<table>
<tr><td>Course Title</td><td colspan="4">Design and Drawing of Irrigation Structures</td><td colspan="4">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">2001707</td><td rowspan="2">Professional Elective (PEC V)</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: 1.5 Hrs</td><td colspan="4">End Exam Duration: 3 Hrs</td></tr>
</table>

Course Objectives:

- To study the preliminary and secondary investigations required for hydraulic structures.
- To study the different methods for estimating of peak flow.
- To study in detail design procedures and their site-specific criteria.
- To study the different safety measures required for during operations of irrigation structures.

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

CO 1	Gain knowledge and use or apply theory / design principles of surplus weir works.
CO 2	Understand the importance and easily recognize the structure in broadest context of canal drop works.
CO 3	Apply engineering fundamentals to study stability and design aspects of tower head.
CO 4	Identify components of canal regulator and design aspects of Vent way.
CO 5	Design canal drop structures based for different filed conditions.

UNIT-I

Design of surplus Weir

Introduction – Estimation of Flood Discharge – Selection of type of Work – Length of Surplus Weir – Crest Width Base Width – Abutments – Wings Returns – Aprons.

UNIT – II

Canal Drop (Notch Type)

Trapezoidal Notch Length of Drop Wall Between Abutments – Profile of Drop Wall – Notch Pier – Protective Works.

UNIT – III

Tank Sluice with Tower Head

Vent Way Design – Sluice Barrel Tower Head – R.C Slab – Earth Pressure – Stability Analysis – Tower Head Design – Cistern.

UNIT – IV

Canal Regulator

Vent Way Design – Drowning Ratio Method – Roadway – Piers Shutters, Abutments – Wing Walls – Return Walls –Solid Apron for Regulator.

UNIT – V

Glacis Type of Canal Drop

Design of throat – Fluming Ratio – Crest Level – Length of weir crest – U/S & D/S side Glacis – Baffle platform – Canal approach – Protective works.

Text Books:

1. C Satyanarayana Murty "Water Resources Engineering – Principles and Practice", New Age International (P) Limited, Publishers, New Delhi.
2. Irrigation engineering and Hydraulic structures by S.K.Garg, Standard Book House.

Reference Books:

1. Santosh Kumar Garg "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.
2. N Balasubramanya "Hydraulic Structures and Irrigation Design Drawing", Sapna Book House and Publishers, Bangalore

<table>
<tr><td>Course Title</td><td colspan="5">Construction Practice and Management</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">2001708</td><td rowspan="2">Professional Elective (PEC-V)</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>
</table>

Course Objectives:

- To equip students with the understanding of the importance of construction management, resource management and various stages of construction project
- To give students, the understanding of various concepts involved in construction planning and the ability to schedule the construction activities using various scheduling techniques
- To understand various types of equipment in construction and the effect of mechanization on productivity
- Understand importance and procedure of inspection, Quality control and ethical audit.
- To know the importance of safety measures in construction activity and principles of organization for effective communication

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

CO 1	Understand the importance of construction management, resource management along with various stages of construction project
CO 2	Schedule construction activities using various scheduling techniques
CO 3	Understand various types of equipment in construction and the effect of mechanization on productivity.
CO 4	Inspect the construction activities and perform quality control of various construction activities.
CO 5	Know the importance of safety measures in construction activity and principles of organization for effective communication

UNIT – I

Introduction

Significance of Construction Management – Objectives and Functions of Construction Management – Types of Construction – Resources for Construction Industry – Stages of Construction – Construction Team and Engineering Drawings.

UNIT – II

Construction Planning

Work-breakdown structure, methodology of WBS, planning techniques—terminologies used, event and activity, dummy activity, network, precedence, network logic, duration of an activity, forward and backward pass, float or slack time. Path and critical path, bar charts, reparation of network diagram, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), the Line-Of-Balance (LOB), network techniques advantages, disadvantages.

UNIT – III

Construction Equipment and Management

Equipment Requirements in Construction Industry, Heavy Earth Moving Equipment – Bulldozers, Scrapers, Loaders Shovels and Cranes Compaction Equipment, Grading Equipment, Aggregate Production Equipment, Asphalt Mixing Plant and Asphalt Laying Plant, Hauling Equipment, Concrete Mixing Equipment, Material Handling Devices, Pneumatic Equipment, Bridge Construction Equipment, Drilling and Blasting Equipment, Pumping and Dewatering Equipment.

UNIT – IV

Inspection and Quality Control, Ethical Audit

Need for Inspection and Quality Control, Principles of Inspection – Enforcement of Specifications – Stages of Inspection an Quality Control. Introduction – Aspects of Project Realization – Ethical Audit Procedures – The Decision Makers – Variety of Interest – Formulation of Briefs – The Audit Statement and Reviews.

UNIT – V

Safety and Risk, Organization of Construction

Introduction on Safety and Risk – Concept and Importance of Safety – Types of Risks – Safety and Engineers – Safety Measures in Construction Work – Design for Safety – Risk Benefit Analysis – Accidents. Principles of Organization – Communication – Leadership and Human Relations – Types of Organizations Organization for Construction – Temporary Services and Job Layout.

Text Books:

1. P S Gahlot and B M Dhir “Engineering Construction Planning and Management”, New Age International (P) Limited, Publishers, New Delhi.
2. S C Sharma “Construction Equipment and Its Management”, Khanna Publishers, New Delhi.
3. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Building Construction, 10th Edition, Laxmi Publications (P) Ltd., New Delhi, 2010

4. KN Jha, Construction Project Management,1stEdition, Pearson Publications, New Delhi, 2011

Reference Books:

1. M Govindarajan, S Natarajan and V S Senthilkumar "Engineering Ethics", Prentice-Hall of India (P) Limited, New Delhi.
2. Dr. S Seetharaman "Construction Engineering and Management", Umesh Publications, New Delhi.
3. Horpal Singh "Construction Management and Accounts", Tata McGraw-Hill Companies, Inc. New York.
4. P.K. Joy, Total Project Management: The Indian Context, 1st Edition, Mac Millan Publishers India Limited, 199

Course Title	Urban Transportation Planning					B.Tech CE VII Sem (R20)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2001709	Professional Elective (PEC V)	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 study the need of urban transportation planning system.
- To understand different types of transportation surveys.
- To study the process of trip generation and distribution.
- To understand model split and factors affecting it.
- To study the transportation plan preparation for different transit systems

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

CO 1	Justify the need for urban transportation planning.
CO 2	Undertake different traffic surveys required for design of transport system.
CO 3	Plan the process of trip generation and distribution.
CO 4	Understand and evaluate current scenarios of land use.
CO 5	Prepare the transportation plans for urban mass rapid transit systems.

UNIT – I

Introduction to Urban Transportation System Planning

Role of transportation in urban development – Transportation problems in urban areas - Purpose of transportation planning - Transportation planning process and factors affecting it - Travel demand and factors affecting it - Urban transport forecasting

UNIT – II

Transportation Surveys

Study area and zoning - Survey Types: Home interview surveys - Commercial vehicle surveys - Taxi surveys - Road side interview surveys - Post card questionnaire surveys - Registration number surveys - Tag surveys - Public transport surveys - Telephone surveys - Inventory of existing transport facilities.

UNIT – III

Trip Generation and Distribution

Trip generation: Trip purpose, Problems of trip generation -Factors governing trip generation and attraction rates - Trip distribution, Methods of trip distribution: Uniform factor - Average factor – Detroit – Fratar - Furness and Time factor method - Problems based on trip distribution-Modal Split-Modal split in the transport planning process-Problems-Factors affecting modal split.

UNIT – IV

Land-Use-Transport Models

Introduction-Selection of Land -Use-Transport Models-Lowry Derivative Models-Garin-Lowry Model-Applications in India

UNIT – V

Transportation Plan Preparation

Definitions: corridor, corridor traffic forecasting, corridor traffic study, count, segment, point, segment capacity, screen line - Corridor identification - Mass transit system - Urban mass rapid transit system - Rail based transit – Metro, Light rail transit system (LRT), Monorail, Sky rail - Road based transit – Bus rapid transit system (BRTS), Electric trolley bus, commuter Bus / City Bus.

Text Books:

1. Kadiyali. L. R. "Traffic Engineering and Transportation Planning", Khanna Publishers, New Delhi.
2. Hutchinson, B. G "Introduction to Urban System Planning", McGraw Hill.
3. Papa Costas C.S.; Fundamentals of Transportation Engineering, Prentice Hall, India

Reference Books:

1. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Pub. Co
2. Vukan R. Vuchic, Urban Public Transportation System & Technology, Prentice Hall, Inc.
3. Jotin Khisty, C. and Kent Lall, B., Transportation Engineering – An Introduction, Prentice- Hall
4. Salter, R J., Highway Traffic Analysis and Design, ELBS.

<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, 1st 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="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">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>
</table>

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

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

CO 1	Obtain an overview of automotive components, like sensors, actuators, communication protocols and safety systems employed in today's automotive industry.
CO 2	Interface automotive sensors and actuators with microcontrollers.
CO 3	Know, the various display devices that are used in automobiles
CO 4	Identify the elements in the engine management and vehicle management system.
CO 5	Summarize an overview of automotive components, like sensors, actuators, communication protocols and safety systems employed in today's automotive industry.

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.

<table>
<tr><th>Course Title</th><th colspan="5">Robotics and Applications in Manufacturing</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">20OE307</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

- 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. 2.R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.
3. 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.

Course Title	Non-Conventional Energy Sources					B.Tech ME VI Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE309	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

- 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.

UNIT - I

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.

UNIT - II

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.

UNIT – III

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><td>Course Title</td><td colspan="5">Supply Chain Management</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">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.

<table>
<tr><td>Course Title</td><td colspan="4">Introduction to VLSI</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">20OE403</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: 90Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

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 rowspan="1">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>
</table>

Course Objectives:

- To understand the Basics of Telecommunication Engineering.
- To introduce the Elements of Telecommunication systems.
- To provide Knowledge about various communication systems

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

CO 1	Understand the fundamental concepts of Telecommunication Engineering.
CO 2	Understand use of different modulation techniques used in Analog and Digital Communication.
CO 3	Understand different Telecommunication systems like Satellite communication, Optical Fiber communication, Wireless communication, Mobile communication etc. and its applications.
CO 4	Compare and contrast advantages and limitations of various Telecommunication systems.

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.

Course Title	Java Programming (Open Elective Course-II)					B. Tech VI Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE503	OEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Mins					End Exam Duration: 3Hrs			

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="3">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>
<tr><td colspan="9">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</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">Understand the basic concepts related to the operating systems</td></tr>
<tr><td>CO2</td><td colspan="8">Analyze the various process scheduling algorithms and process synchronization mechanisms.</td></tr>
<tr><td>CO3</td><td colspan="8">Analyze the various memory management schemes.</td></tr>
<tr><td>CO4</td><td colspan="8">Understand the ways to deal the deadlocks and the basic concepts related to files in the system.</td></tr>
<tr><td>CO5</td><td colspan="8">Analyze the protection and security mechanism.</td></tr>
</table>

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 System Concepts", Eighth edition, John Wiley.

2. Andrew S Tanenbaum, "Modern Operating Systems", Fourth Edition, PearsonEducation.

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, 4th 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>
<tr><td colspan="9">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 secure integrity and concurrency.</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 basic concepts and the application of Database systems.</td></tr>
<tr><td>CO 2</td><td colspan="8">To understand the basics of SQL and construct queries using SQL.</td></tr>
<tr><td>CO 3</td><td colspan="8">To understand the Relational Database design principles.</td></tr>
<tr><td>CO 4</td><td colspan="8">To apply various Normalization techniques for database design improvement.</td></tr>
<tr><td>CO 5</td><td colspan="8">To apply concurrency control and recovery techniques during transaction execution.</td></tr>
</table>

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.
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 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.

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="4">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>
</table>

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.

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

CO 1	**Understand** and calculate the measures of dispersion
CO 2	**Analyze** probability concepts
CO 3	**Apply** distributions in real life problems.
CO 4	**Justify** hypothesis concepts
CO 5	**Estimate** correlation and regression coefficients

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, 9th 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.

<table>
<tr><td>Course Title</td><td colspan="4">BASICS OF ELECTRICAL, MAGNETIC AND OPTOELECTRONIC MATERIALS</td><td colspan="3">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">20OE608</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.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

<table>
<tr><td>Course Title</td><td colspan="4">Academic Writing</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>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>
</table>

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="4">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>
</table>

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.

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

CO 1	Knowledge of the basics of Financial Management Concepts.
CO 2	To learn the concept of cost of capital and making decisions regarding raising of capital
CO 3	To understand the concept of Capital structure evaluation and related decisions.
CO 4	To build knowledge about financing and estimation of Working capital management.
CO 5	To understand the concepts of TVM, capital budgeting decisions and evaluation of Projects.
CO 6	Understanding of mergers, acquisitions and various other types financial restructurings

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.

<table>
<tr><td>Course Title</td><td colspan="4">Intelligent Control Techniques</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">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="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 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

Course Title	Entrepreneurship					B.Tech ME VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE311	OEC- III	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	--	3	30	70	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs			

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.

<table>
<tr><td>Course Title</td><td colspan="4">Solar Energy Systems</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">20OE312</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>
</table>

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>
</table>

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	Use knowledge and comprehension in management tools to apply in technical organizations.
CO 2	Understand and build their analytical abilities in the use of Industrial Management
CO 3	Use management techniques to direct the organizations/industries for goal achievement
CO 4	Solve problems associated with the operations management and scheduling of resources in efficiently and effectively.
CO 5	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

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

Course Title	Electronic Instrumentation and measurements				Open Electives		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE405	OE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs			

Course Objectives:

- To study Performance characteristics of Instruments.
- To understand the principles in Analog and Digital Instruments.
- To understand the working of CROs, Transducers and bridges.

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

CO 1	**Understand** the performance characteristics of an instrument.
CO 2	**Understand** the principle of analog, digital voltmeters and wave analyzers
CO 3	**Explain** different types of oscilloscopes
CO 4	**Use** AC and DC bridges for relevant parameter measurement.
CO 5	**Apply** the complete knowledge of various electronic transducers to measure the physical Quantities in the field of science and technology

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.

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- Measurements with CRO (Voltage, Current, time, frequency, Phase angle, lissajous figures).

UNIT IV

Bridges: Wheat stone bridge, Kelvin Bridge, Measurement of inductance-Maxwell's bridge, Anderson Bridge. Measurement of capacitance-Schearing Bridge, Wien Bridge Errors and precautions 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, velocity, 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”,PHI, 5th Edition, 2002.

References:

1. David A. Bell, “Electronic Instrumentation & Measurements”, PHI (OUP), 2nd Edition, 2003.
2. Robert A.Witte, “Electronic Test Instruments, Analog and Digital Measurements”, Pearson Education, 2nd Ed., 2004.
3. K. Lal Kishore, “Electronic Measurements & Instrumentations”, by Pearson Education – 2005.

<table>
<tr><td>Course Title</td><td colspan="4">Introduction to IOT</td><td colspan="4">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">20OE406</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>
</table>

Course Objectives:

- To understand the basics of IOT.
- To study the Programming Using Arduino.
- To provide the knowledge about sensors and transducers.

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

CO 1	Understand about IoT, its Architecture and its Applications, basic electronics used in IoT & its role.
CO 2	Develop applications with C using Arduino IDE.
CO 3	Analyze about sensors and actuators.
CO 4	Design IoT in real time applications using today's internet & wireless technologies.

Unit I

INTRODUCTION: Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications Applications of IoT – Industrial IoT – Security in IoT.

Unit II

BASIC ELECTRONICS FOR IoT: Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.

Unit III

PROGRAMMING USING ARDUINO: Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.

Unit IV

SENSORS AND ACTUATORS: Analog and Digital Sensors – Interfacing temperature sensor, ultrasound sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.

Unit V

SENSOR DATA IN INTERNET: Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE –

Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (ThingSpeak).

Text Books

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-On Approach”, 2014. ISBN: 978-0996025515.
2. Boris Adryan, Dominik Obermaier, Paul Fremantle, “The Technical Foundations of IoT”, Artech Houser Publishers, 2017.

Reference Books

1. Michael Margolis, “Arduino Cookbook”, O‟Reilly, 2011.
2. Marco Schwartz, “Internet of Things with ESP8266”, Packt Publishing, 2016.
3. Dhivya Bala, “ESP8266: Step by Step Tutorial for ESP8266 IoT, Arduino NODEMCU Dev. Kit”, 2018.

<table>
<tr><td>Course Title</td><td colspan="4">Nano Electronics</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">20OE407</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>
</table>

Course Objectives:

- To understand the principles of tunneling, lithography and scaling of physical systems.
- To provide the knowledge about MEMS and NEMS.

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

CO 1	Understand the divers electronic and device fabrication.
CO 2	Demonstrate the applications of FET and MOSFET
CO 3	Describe lithography.
CO 4	Analyze MEMS and NEMS

Unit-I

Tunnel junction and applications of tunneling, Tunneling Through a Potential Barrier, Metal—Insulator, Metal-Semiconductor, and Metal-Insulator-Metal Junctions, Coulomb Blockade, Tunnel Junctions, Tunnel Junction Excited by a Current Source. Spintronics and Foundations of nano-photonics.

Unit-II

Field Emission, Gate—Oxide Tunneling and Hot Electron Effects in nano MOSFETs, Theory of Scanning Tunneling Microscope, Double Barrier Tunneling and the Resonant Tunneling Diode.

Unit-III

Introduction to lithography- Contact, proximity printing and Projection Printing, Resolution Enhancement techniques, overlay-accuracies, Mask-Error enhancement factor (MEEF), Positive and negative photoresists, Electron Lithography, Projection Printing, Direct writing, Electron resists. Lithography based on Surface Instabilities: Wetting, De-wetting, Adhesion, Limitations, Resolution and Achievable / line widths etc. Lift off process, Bulk Micro machining.

Unit-IV

Introduction to MEMS and NEMS, working principles, as micro sensors (acoustic wave sensor, biomedical and biosensor, chemical sensor, optical sensor, capacitive sensor, pressure sensor and thermal sensor), micro actuation (thermal actuation, piezoelectric actuation and electrostatic actuation–micro gripers, motors, valves, pumps, accelerometers, fluidics and capillary electrophoresis, active and passive micro fluidic devices, Piezoresistivity, Piezoelectricity and thermoelectricity, MEMS/NEMS design, processing, Oxidation, Sputter deposition, Evaporation, Chemical vapor deposition etc.

Unit-V

Introduction – Scaling of physical systems – Geometric scaling & Electrical system scaling.

The Single-Electron Transistor: The Single- Electron Transistor Single-Electron Transistor Logic, Other SET and FET Structures, Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs,Coulomb Blockade in a Nanocapacitor, Molecular SETs and Molecular Electronics.

Text Book:

1. Stephen D. Sentaria, *Microsystem Design, Kluwer Academic Press*
2. Marc Madou, *Fundamentals of microfabrication & Nanofabrication.*
3. T. Fukada & W.Mens, *Micro Mechanical system Principle & Technology, Elsevier, 1998.*
4. Julian W.Gardnes, Vijay K. Varda, *Micro sensors MEMS & Smart Devices, 2001.*

Reference Books:

1. WR Fahrner, “Nano Terchnology and Nano Electronics – Materials, devices and measurement Techniques”,Springer.
2. T.Pradeep, “Nano: The Essentials – Understanding Nano Scinece and Nanotechnology”, Tata Mc.Graw Hill.
3. M. Ziese and M.J. Thornton, “Spin Electronics”
4. Karl Goser, Peter Glosekotter, Jan Dienstuhl, “Nanoelectronics and Nanosystems – From Transistor to Molecular and Quantum Devices”.

<table>
<tr><td>Course Title</td><td colspan="5">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, 4th Edition, S Chand Publishers.

Course Title	R Programming (Open Elective Course - III)					B.Tech VII Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE506	OEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
					End Exam Duration: 3Hrs			

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>
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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 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 Computing Era, 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, CRCPressT&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>
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<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.

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 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 application development, R.A. Johnson- Thomson.
3. Object Oriented Programming through Java, P. Radha Krishna, University Press.

<table>
<tr><td>Course Title</td><td colspan="5">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>
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<tr><td colspan="5">Mid Exam Duration: 90 min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

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.

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

CO 1	**Understand** Laplace Transforms in engineering problems.
CO 2	**Apply** Laplace Transforms in engineering problems.
CO 3	**Understand** Fourier Transforms in engineering problems.
CO 4	**Apply** Fourier Transforms in engineering problems.
CO 5	**Understand** concept of Z-Transforms and its applications.

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:

5. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-43 edition 2014.
6. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9^{th} edition-2013.
7. Engineering Mathematics Volume-1, Dr. D.S Chandra Sekharaiah, Prism Books Pvt. Ltd.
8. Engineering Mathematics by Srimanta Pal, Subodh C. Bhunia, Oxford University Press.

Reference Books:

5. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt. Ltd, New Delhi, 11^{th} Edition, Reprint 2010.
6. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, Lakshmi Publications, Reprint 2008.
7. Advanced Engineering Mathematics, Greenberg Michael D, Cengage Publishers.
8. Introduction to Laplace Transforms and Fourier Series, Philip Dyke, Springer.

<table>
<tr><td>Course Title</td><td colspan="5">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>
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<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

<table>
<tr><td>Course Title</td><td colspan="5">Fuel Technology</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>
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<tr><td colspan="5">Mid Exam Duration: 90 Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

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

<u>Textbooks:</u>

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>
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<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.

<table>
<tr><td colspan="2">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td>The students will be able to understand the processes of communication and apply communication techniques for effective communication.</td></tr>
<tr><td>CO 2</td><td>The students will be able to improve group behaviour and participate effectively in the team work thereby improving professional prospects.</td></tr>
<tr><td>CO 3</td><td>The students will be able to present effectively orally and in writing</td></tr>
</table>

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", 2ndEdition, 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="4">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>
<tr><td colspan="9">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</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 the role and importance of digital marketing, Ability to comprehend how digital media can be used for current marketing practices.</td></tr>
<tr><td>CO 2</td><td colspan="8">Understanding of Search Engine optimization, Pay per click and Email marketing,</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze the role that social media marketing plays in the digital landscape and marketing mix.</td></tr>
<tr><td>CO 4</td><td colspan="8">Identify and incorporate individual social and mobile media platforms into a digital marketing strategy.</td></tr>
<tr><td>CO 5</td><td colspan="8">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.</td></tr>
</table>

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

Text Books

1. Digital Marketing: by Raghavendra K & ShrutiPrabhakar, HPH

References

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">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, 2^{nd} Edition 1998.

Reference Books

1. Power Electronics- P.S. Bimbhra, Khanna Publications.
2. Power Electronics –Vedam Subramanyam, New Age Information Limited, 3^{rd} Edition.
3. Power Electronics –V.R. Murthy, Oxford University Press, 1^{st} 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.

<table>
<tr><td>Course Title</td><td colspan="4">Energy Auditing</td><td colspan="4">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">20OE314</td><td rowspan="2">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="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">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.</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 the fundamental aspects of energy scenario in India.</td></tr>
<tr><td>CO 2</td><td colspan="8">List the various national and state level energy policy.</td></tr>
<tr><td>CO 3</td><td colspan="8">Explain the concepts of energy conservation in boilers.</td></tr>
<tr><td>CO 4</td><td colspan="8">Identify the thermal energy components.</td></tr>
<tr><td>CO 5</td><td colspan="8">Explain the concepts of supply side methods to minimize supply.</td></tr>
</table>

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)

<table>
<tr><td>Course Title</td><td colspan="4">Sustainable Engineering</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">20OE315</td><td rowspan="2">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="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

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

<table>
<tr><td>Course Title</td><td colspan="4">Industrial Engineering & Management</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">20OE316</td><td rowspan="2">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="5">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

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="4">Fundamentals of RADAR Engineering</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">20OE408</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="6">Mid Exam Duration: 90 Min</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To gain the knowledge about radar subsystems, their performance and key functions.
• To provide the in depth knowledge and issues related various tracking radars.</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 essential principles of operation of radar systems.</td></tr>
<tr><td>CO 2</td><td colspan="8">Describe the various Radar components</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze different Radar systems</td></tr>
<tr><td>CO 4</td><td colspan="8">Analyze the different Tracking methods</td></tr>
</table>

UNIT-I

Fundamentals: Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Radar block diagram and operation, Radar frequencies, Applications of Radar, simple form of radar range equation. Integration of Radar pulses, Radar cross-Section of targets, PRF.

UNIT-II

Radar components: RF amplifier, TWT, CFA, Modulators, Mixers-Conversion loss, Noise figure, Types of Mixers, Duplexers-Branch type, Balanced and Solid state Duplexers, Displays-CRT displays, A, B, C, E-scopes, PPI, RHI.

UNIT-III

Radar systems: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, FMCW radar, multiple frequency C.W radar.

UNIT-IV

MTI and Pulse Doppler radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance. Non-coherent MTI, MTI versus Pulse Doppler radar.

UNIT-V

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase

Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers.

Text Books:

1. Merrill I.Skolnik, “Introduction to Radar Systems”, 2^{nd} edition-TMH 1980.

2. N.S. Nagaraja, “Elements of electronic navigation, 2^{nd} edition-TMH 1996.

<table>
<tr><td>Course Title</td><td colspan="4">Biomedical Instrumentation</td><td colspan="3">Minor Degree</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">2091409</td><td rowspan="2">EC</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>
</table>

Course Objectives:

- To Understand the functioning of Human Cell and its electrical characteristics
- To Understand the functioning of cardiovascular measurement and circulatory System of heart CO3: Describe various bioelectrodes
- To Describe Organization of cell and various potentials
- To Analyze 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 Human Cell and its electrical characteristics
CO 2	Understand the functioning of cardiovascular measurement and circulatory System of heart
CO 3	Describe various bioelectrodes
CO 4	Describe Organization of cell and various potentials
CO 5	Analyze the electrical hazards that may occur during the usage of medical instruments.

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

Organization of cell: Derivation of Nernst equation for membrane Resting Potential Generation and Propagation of Action Potential, Conduction through nerve to neuro-muscular junction.

UNIT III

Bio Electrodes: Bio-potential Electrodes-External electrodes, Internal Electrodes. Biochemical Electrodes.Mechanical function, Electrical Conduction system of the heart, Cardiac cycle. Relation between electrical and mechanical activities of the heart. Pacemaker, Defibrillator

UNIT IV

Cardiac Instrumentation Blood pressure and Blood flow measurement: Specification of ECG machine. Einthoven triangle, Standard 12-lead configurations, Therapeutic equipment, Shortwave diathermy.

Respiratory Instrumentation: Mechanism of respiration, Spirometry, Pnemuotachograph Ventilators.

UNIT V

Physiotherapy and Electrotherapy Equipment: High frequency heat therapy, Short wave Diathermy, Microwave Diathermy, Ultrasonic Therapy Unit, Electro diagnostic/ Therapeutic Apparatus, Pain relief through electrical stimulation, Diaphragm pacing by Radio-frequency for the treatment of chronic ventilator insufficiency, Bladder stimulators.

Patient electrical safety: Types of hazards, natural protective mechanism, leakage current, patient isolation, hazards in operation rooms, grounding conditions in hospital environment.

Text Books:

1. Leslie Cromwell and F.J. Weibell, "Biomedical Instrumentation andMeasurements ",E.A. Pfeiffer, PHI, 2nd Ed, 1980.
2. John G. Webster, "Medical Instrumentation, Application and Design",John Wiley,3rd Ed., 1998.

Reference Books:

1. L.A. Geoddes and L.E. Baker, " Principles of Applied Biomedical Instrumentation", John Wiley,1975.
2. R.S. Khandpur, " Hand-book of Biomedical Instrumentation", TMH, 2nd Ed.,2003.
3. Mackay, Stuart R., "Biomedical Telemetry",–John Wiley,1968.
4. M. Armugam, "Biomedical Instrumentation", Anuradha agenciespublications.

Course Title	Digital Circuits					Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2091410	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs			

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	Understand various number systems and binary codes.
CO 2	Understand the postulates, theorems and properties of Boolean algebra.
CO 3	Describe 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, digital logic gates –universal gates-Multilevel NAND/NOR realizations. The K- map method, tabulation method.

UNIT-III

Combinational Logic Design: Design using conventional logic gates, Half and Full Adders, Subtractors, 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, 2ndEdition.
2. Morris Mano, “Digital Design”, PHI, 3rd Edition, 2006.
3. A. Anand Kumar, “Switching Theory & Logic Design”, 2008, PHI.

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, 2^{nd} 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. Charles H. Roth, “Fundamentals of Logic Design”, Thomson Publications, 5th Edition,2004.
6. John M. Yarbrough, “Digital Logic Applications and Design”, Thomson Publications,

Course Title	Python Programming (Open Elective Course -IV)					B. Tech VII Sem (R20) CSE		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20OE508	OEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Mins					End Exam Duration: 3Hrs			

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="4">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="4">DATA ANALYTICS WITH PYTHON
(Open Elective Course – IV)</td><td colspan="3">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>
<tr><td colspan="9">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.</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 and acquire knowledge on usage of Data types, operators, input and output statements in python programming.</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze the given problem and develop python program to solve the problem.</td></tr>
<tr><td>CO 3</td><td colspan="8">Able to use proper iterative statements in problem solving.</td></tr>
<tr><td>CO 4</td><td colspan="8">Entity the right sequence to solve the real-world problems.</td></tr>
<tr><td>CO 5</td><td colspan="8">Apply object-oriented features to solve real time applications.</td></tr>
</table>

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 and expressions, 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, 4^{th} 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>
</table>

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.

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

CO1	Enumerate the Basic Concepts of Markup Languages.
CO2	Develop web Applications using CSS and different page layout.
CO3	Make use of decisions, loops, strings in PHP
CO4	Make use of functions, creating HTML forms with PHP.
CO5	Accessing database through PHP.

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="5">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="4">FUNDAMENTALS OF QUANTUM COMPUTATION AND NANO PHOTONICS</td><td colspan="4">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="6">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="4">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 colspan="2">Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td colspan="2">100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 90 Min</td><td colspan="5">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="10">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="10">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="9">Understand the tolls & Principles of Green Chemistry</td></tr>
<tr><td>CO 2</td><td colspan="9">Knowledge of applications of green routes for synthesis of chemicals</td></tr>
<tr><td>CO 3</td><td colspan="9">Synthesis of biocatalysts using different techniques</td></tr>
<tr><td>CO 4</td><td colspan="9">Analyze about trends of solvent free chemical reactions</td></tr>
<tr><td>CO 5</td><td colspan="9">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.

<table>
<tr><td>Course Title</td><td colspan="5">Creative Writing</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">20OE620</td><td rowspan="2">HUM</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Internal Assessment</td><td>External 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: 90 Min</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
</table>

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="5">Materials Management</td><td colspan="3">B. Tech.
Open Elective - IV</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>
<tr><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>20OE621</td><td>Open Elective (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="6">Mid Exam Duration: 90 Min</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">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.</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">Remembering the concepts of purchases, vendors, materials handling, inventory types etc.</td></tr>
<tr><td>CO 2</td><td colspan="8">An understanding of basic concepts in Materials management and modern trends inmaterials management</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze the processes of vendor management, material handling, ABC analysis andEOQ etc...</td></tr>
<tr><td>CO 4</td><td colspan="8">An understanding of principle of materials handling and evaluation of material handling performance.</td></tr>
<tr><td>CO 5</td><td colspan="8">Able to apply the techniques of inventory management.</td></tr>
</table>

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

<table>
<tr><th>Course Title</th><th colspan="5">Practices in Geo-Technical Engineering</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><th rowspan="2">20015S5</th><th rowspan="2">Skill Oriented Course (SOC V)</th><th>L</th><th>T</th><th>P</th><th>C</th><th>Continuous Internal Assessment</th><th>End Exam</th><th>Total</th></tr>
<tr><th>1</th><th>0</th><th>2</th><th>2</th><th>40</th><th>60</th><th>100</th></tr>
<tr><th colspan="6">Mid Exam Duration: 1.5 Hrs</th><th colspan="3">End Exam Duration: 3 Hrs</th></tr>
</table>

Course Objectives:

- To introduce traditional program consisting mostly of practical courses related to geotechnical engineering.
- To apply the knowledge of science, mathematics and engineering with the context of applications in geotechnical engineering.
- To design and conduct experiments, analyze and interpret data related to the various laboratory tests studied in geotechnical engineering.
- To classify the soils based on the field identification (coarse and fine)
- To estimate the bearing capacity and design the various types of foundations

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

CO 1	Do various soil identification and classification tests
CO 2	Select suitable boring methods to collect the soils
CO 3	Use the modern equipment to find the shear and settlement properties of the soils
CO 4	Select the testing facilitates to cater the requirement of selection of proper soil type as per the requirement.
CO 5	Use the techniques, skills, and modern tools necessary for engineering practice.

UNIT – I

Field Identification of Soils

Identifying soils for various types of constructions, Preparation of Report

UNIT – II

Soil Sample Collection Methods

Types of samples and samplers - Types of Augers, Boring methods

UNIT – III

Advanced Testing Methods

Field CBR Method, Triaxial Shear Test (Digitized), Consolidation Test (Digitized)

UNIT – IV

Penetration Methods

Standard Penetration Test, Cone Penetration Test

UNIT – V

Designs of SBC and types of foundations using software tools

Bearing capacity by Terzaghi, Mayerhoff, Vesic methods – Design of footings for multistory structure, silos, transmission tower, and machines.

Text Books:

1. S Mittal and J P Shukla "Soil Testing for Engineers", Khanna Publishers, New Delhi.
2. T G Sitharam and T N Ramamurthy "Geotechnical Engineering", S Chand Publishing, New Delhi
3. Analysis and Design of Foundation - J. E. Bowles
4. Engineering Properties of Soil and Their Measurements- Bowles J.E. (1988), - McGraw Hill Book Co. New York

Reference Books:

1. Foundation Engineering - M.J. Tomlinson
2. Analysis and Design of Substructures - Swami Saran
3. Foundation Design – Coduto
4. SP 36 Compendium of Soil Mechanics (Part – 1 & 2)
5. IS: 2911 (All Parts)

<table>
<tr><td>Course Title</td><td colspan="4">Industrial/Research Internship</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">2001710</td><td rowspan="2">PR</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>6</td><td>6</td><td>100</td><td>---</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: ----</td><td colspan="3">End Exam Duration: ----</td></tr>
</table>

Course Objectives:

- To apply the concepts and theories learned in classroom to real world civil engineering problems.
- To develop proficiency in using industry specific software, tools and equipment used in civil engineering projects.
- To enhance ability to work effectively in multidisciplinary team environment and industry professionals.
- To develop critical thinking and problem solving skills by tackling real life engineering challenges and proposing viable solutions.
- To inculcate the report writing and effective communication skills of the work done.

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

CO 1	Understand how engineering principles and concepts are implemented in practical problems.
CO 2	Gain hands on experience and exposer to real world civil engineering projects enabling to apply theoretical knowledge to practical situations.
CO 3	Contribute to the planning, design, construction or maintains of civil engineering projects.
CO 4	Apply analytical and critical thinking skills to identify and solve engineering challenges encountered during internship.
CO 5	Prepare professional documentation for the work carried out

A student may complete the training before the beginning of 7th semester and the evaluation and credits will be awarded in 7th semester through internal assessment process only. The duration of the internship or practical training will be for a minimum of 4 weeks. Internship must be undertaken in physical mode/online mode in industry/R&D organisations/Premier educational institutes. Internship must focus on Civil Engineering domain/allied areas. The award of credits for internship will be based the performance in Viva-Voce and report submitted.

B.Tech VIII SEM CE (R20)

<table>
<tr><td>Course Title</td><td colspan="6">Project Work/Internship</td><td colspan="3">B.Tech CE VIII Sem (R20)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="4">Maximum Marks</td></tr>
<tr><td rowspan="2">2001801</td><td rowspan="2">PROJ</td><td>L</td><td>T</td><td>P</td><td>C</td><td colspan="2">Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>12</td><td colspan="2">40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: ----</td><td colspan="4">End Exam Duration: ----</td></tr>
</table>

Course Objectives:

- To apply the theoretical knowledge and practical skills they have acquired throughout their coursework to a real-world project.
- To identify and define a problem or research question, analyze it critically, and propose effective solutions or outcomes.
- To develop their research skills, including literature review, data collection methods, data analysis, and interpretation
- To plan, organize, and manage their project activities effectively
- To communicate their project findings, methodologies, and outcomes effectively

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

CO 1	Use engineering knowledge to choose an appropriate topic for study.
CO 2	Identify the needs and requirements of a specific civil engineering task
CO 3	Plan and design the task at hand with the help of appropriate conventional and modern methods/tools.
CO 4	Build professional competence and confidence in students to take up civil engineering assignments.
CO 5	Prepare professional documentation for the work carried out.

The project work can be a design project/experimental project/field surveying/computer oriented on any of the topics of civil engineering/allied domain. The internal assessment will be done through three progress seminars during eight semester reviewed by internal committee members. A consolidated six to ten pages of typed report based on the progress work done have to be submitted by the batch of students to the assessing committee during each review process. The external assessment of the project will be done at the end of the semester by a committee consisting of both internal and external faculty members specialized in various fields of Civil Engineering. The students will present their project work before the committee. Each group will submit the copies of the completed project report signed by the guide to the department. The head of the department will certify the copies and return the reports to the students. Students have to submit the three hard copies, one copy to the respective guide, one copy to the departmental library and another copy to the college library.