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

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

Index

1.0 Nomenclature

1.1 *Academic Year*: Period of academic instruction of, approximately, one year duration that 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 Civil Engineering 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 no credits 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 a scheduled 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's minor area of study

1.20 *Honours*: An Academic honour conferred on achieving 20 extra credits in one's major 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2.1 These rules and regulations may be called as R20UG and come into force from Academic Year 2020-21 and exists until superseded by new regulations.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 regulations will 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 of the Institute.

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 and 60 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 the marks 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 or sudden 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 that assignment.

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, she or 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 by a 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 be

considered 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 of that 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 subject and 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. CGPA is 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 as follows:

Equivalent Percentage = (CGPA – 0.50) x 100

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 to be 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.

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.

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% attendance in 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 marks will be awarded for that subject.

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

12.0 Supplementary End Examinations

12.1 Students are eligible to take Supplementary examinations in subjects with fail grade either 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 eighth semester.

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 be removed 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 as follows:

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. (of 8 week duration)

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 R20UG

a) *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).

b) *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.

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

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

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

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

15.0 Transitory Regulations

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

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 labour yields fruits from nature.

2.2 Creative Arts

Every student would chose 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 R20UG 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.

K. S. R. M. College of Engineering - KADAPA

(AUTONOMOUS)

Minor Degree in Civil Engineering

B. Tech. – R20 Regulations

Department of Civil Engineering

Minor Degree Course Structure

S. No.	Subject Code	Subject Name	L	T	P	IM	EM	CR
1	2091101	Engineering Mechanics	4	0	0	40	60	4
2	2091102	Surveying	4	0	0	40	60	4
3	2091103	Building Technology	4	0	0	40	60	4
4	2091104	Estimating and Costing	4	0	0	40	60	4
5	2091105	Water Supply Engineering	4	0	0	40	60	4
6	2091106	Construction Practice and Management	4	0	0	40	60	4
7	2091107	Soil Mechanics	4	0	0	40	60	4

Important Instructions:

1. Any four courses from above list can be selected by students.
2. The student can complete any two subjects under MOOC/NPTEL and approved by BOS Chairman.
3. Total Credits required to award Minor degree are 20. The four theory subjects must be completed, each subject carries 4 credits (total 16 credits) and two MOOC/NPTEL carries 4 credits.

K. S. R. M. College of Engineering - Kadapa
(AUTONOMOUS)

Minor Degree in Electrical Engineering

R20UG Regulations

Department of Electrical and Electronics Engineering

Minor Degree Course Structure

S. No.	Subject Code	Subject Name	SC	L	T	P	IM	EM	CR
1	20MD201	Circuits Theory	PCC	4	0	0	40	60	4
2	20MD202	Basics of Electrical Measurements & Instrumentation	PCC	4	0	0	40	60	4
3	20MD203	Electrical Machines	PCC	4	0	0	40	60	4
4	20MD204	Principles of Power Systems	PCC	4	0	0	40	60	4
5	20MD205	Linear Control Engineering	PCC	2	0	0	40	60	2
6	20MD206	Principles of Power Electronics	PCC	2	0	0	40	60	2
Total				20	00	00	240	360	20

Important Instructions:

1. Any four courses from above list can be selected by students.
2. The student can complete any two subjects under MOOC/NPTEL and approved by BOS Chairman.
3. Total Credits required to award Minor degree are 20. The four theory subjects must be completed, each subject carries 4 credits (total 16 credits) and two MOOC/NPTEL carries 4 credits.

K. S. R. M. College of Engineering - Kadapa
(AUTONOMOUS)

Minor Degree in Mechanical Engineering

R20UG Regulations

Department of Mechanical Engineering

Minor Degree Course Structure

S. No.	Subject Code	Subject Name	SC	L	T	P	IM	EM	CR
1	20MN301	Material Science and Engineering							4
2	20MN302	Thermodynamics							4
3	20MN303	Kinematics of Machinery							4
4	20MN304	Instrumentation and Control Systems							4
5	20MN305	Heat Transfer							4
6	20MN306	Design of Machine Elements							2
7	20MN307	Metrology							2
8	20MN308	Gas turbine & Jet Propulsion							2
9	20MN309	Computer Aided Design							2
10	20MN310	Composite and Nano Materials							2
11	20MN311	Manufacturing Technology							2
Total									

Important Instructions:

1. Any four courses from above list can be selected by students.
2. The student can complete any two subjects under MOOC/NPTEL and approved by BOS Chairman.
3. Total Credits required to award Minor degree are 20. The four theory subjects must be completed, each subject carries 4 credits (total 16 credits) and two MOOC/NPTEL carries 4 credits.

K. S. R. M. College of Engineering - Kadapa
(AUTONOMOUS)

Minor Degree in Electronics and Communication Engineering

R20UG Regulations

Department of Electronics and Communication Engineering

Minor Degree Course Structure

S. No.	Subject Code	Subject	L	T	P	IM	EM	CR
1	2092401	Scientific Computing using MATLAB	4	0	0	40	60	4
2	2091402	Digital Circuits	4	0	0	40	60	4
3	2091403	Signals and systems	4	0	0	40	60	4
4	2091404	Probability Theory and Stochastic Processes	4	0	0	40	60	4
5	2091405	Network theory	4	0	0	40	60	4
6	2091406	Microprocessors & Microcontrollers	4	0	0	40	60	4
7	2091407	Principles of communication systems	4	0	0	40	60	4
8	2091408	Analog and digital IC applications	4	0	0	40	60	4
9	2091409	Industrial electronics	4	0	0	40	60	4
10	2091410	Digital signal processing.	4	0	0	40	60	4
11	2091411	Embedded system design	4	0	0	40	60	4
12	2091412	Electronic Instrumentation and measurements	4	0	0	40	60	4
13	2091413	VLSI Design	4	0	0	40	60	4
14	2091414	Digital Image Processing	4	0	0	40	60	4
15	2091415	Biomedical Instrumentation	4	0	0	40	60	4

Important Instructions:

1. Any four courses from above list can be selected by students.
2. The student can complete any two subjects under MOOC/NPTEL and approved by BOS Chairman.
3. Total Credits required to award Minor degree are 20. The four theory subjects must be completed, each subject carries 4 credits (total 16 credits) and two MOOC/NPTEL carries 4 credits.

K. S. R. M. College of Engineering - Kadapa
(AUTONOMOUS)

Minor Degree in Computer Science Engineering

R20UG Regulations

Department of Computer Science Engineering

Minor Degree Course Structure

S.No	Subject Code	Subject Name	Semester	L-T-P	CR
1	2091501	Computer Networks	V	4-0-0	4
2	2091502	Computer Organization	V	4-0-0	4
3	2091503	Mobile Application Development	VI	4-0-0	4
4	2091504	Artificial Intelligence	VI	4-0-0	4
5	2091505	Cryptography & Network Security	VII	MOOC	2
6	2091506	Big Data Technologies	VII	MOOC	2
7	2091507	Internet of Things	VII	MOOC	2
8	2091508	Software Engineering	VII	MOOC	2
9	2091509	Design and Analysis of Algorithms	VII	MOOC	2
10	2091510	Natural Language Processing	VII	MOOC	2

Important Instructions:

1. A total of 6 Subjects must be taken.
2. In the above 6 MOOC subjects, the student can select any two subjects under MOOC/NPTEL, the credits for the MOOC/NPTEL subject is two only.
3. Total Credits required to award Minor degree are 20. The four theory subjects must be completed, each subject carries 4 credits (total 16 credits) and two MOOC/NPTEL carries 4 credits.

K. S. R. M. College of Engineering - Kadapa
(AUTONOMOUS)

Minor Degree in Artificial Intelligence & Machine Learning

R20UG Regulations

Department of Artificial Intelligence & Machine Learning

Minor Degree Course Structure

S.No.	Course Code	Course Name	Semester	Hours per Week			IM	EM	Credits
				L	T	P	40	60	
1	20913901	Computer Networks	V	4	0	0	40	60	4
2	20913902	Computer Organization	V	4	0	0	40	60	4
3	20913903	Mobile Application Development	VI	4	0	0	40	60	4
4	20913904	Artificial Intelligence	VI	4	0	0	40	60	4
5	20913905	Introduction to Machine Learning	VII	MOOC			---	---	2
6	20913906	Internet of Things	VII	MOOC			---	---	2
7	20913907	Python Programming	VII	MOOC			---	---	2
8	20913908	Java Programming	VII	MOOC			---	---	2
9	20913909	Big Data Technologies	VII	MOOC			---	---	2
10	20913910	Data Science	VII	MOOC			---	---	2

Note: Students can do any two MOOC from the list given above

Minor Degree Course Syllabus

<table>
<tr><td>Course Title</td><td colspan="4">Engineering Mechanics</td><td colspan="3">B. Tech. CE (Minor Degree)</td></tr>
<tr><td>Course Code</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2091101</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>4</td><td>0</td><td>0</td><td>4</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 1.5 Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives:
• To make the students understand the various forces on rigid bodies and its applications on different types of force system.
• To impart the knowledge on support reactions of different beams under different loads.
• To make students understand different types of frictions on bodies with horizontal and inclined planes.
• To calculate Center of gravity, Centroid of solids and surfaces.
• To calculate Moment of inertia for different geometric shapes and sections .</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="7">Understand the different types of forces systems and its effect on rigid bodies</td></tr>
<tr><td>CO 2</td><td colspan="7">Evaluate the reactive forces of beams and understand the concepts of friction</td></tr>
<tr><td>CO 3</td><td colspan="7">Compute and understand tensile and compressive axial forces under different nodal loads.</td></tr>
<tr><td>CO 4</td><td colspan="7">Compute Centre of gravity and Centroid of different geometrical shapes</td></tr>
<tr><td>CO 5</td><td colspan="7">Compute moment of inertia of different geometric shapes and various practical standard section available in construction industry.</td></tr>
</table>

UNIT-I

Basic Concepts and Coplanar Force Systems: Concept of Force, particle and rigid body – Basic laws of mechanics – Newton's laws – Dimensions and units – Numerical accuracy – Operations with forces: Addition and resolution – moment about a point, couple, replacing force-

couple system by a single force – resultant of a coplanar force system: resultant of concurrent system, parallel system, non-concurrent and non-parallel system – Concept of equilibrium – Applications of concurrent, parallel, non-concurrent and non-parallel systems

UNIT – II

Beams and Friction:

Beams: Types of supports: simple, roller, fixed, inclined roller – Types of beams: simple, cantilever, propped, fixed and continuous beams – Types of Loads: point, UDL, UVL – Free body diagrams – Support reactions for determinate beams with concentrated and distributed loads.

Friction: Types of Friction – Laws of friction – Cone of limiting friction – Static and Dynamic frictions – Ladder friction.

UNIT – III

Analysis of Plane trusses:

Trusses – Uses - Parts of truss – Geometry: Partt, Warren, North Light, Howe, Fink – Stability – Cantilever and Simply supported trusses – Analysis of Trusses using Method of Joints and Method of Sections

UNIT – IV

Properties of Plane Areas:

Centroids of simple areas – Centroids of composite areas – Second and Product moment of areas – Parallel axis and Perpendicular axis theorems – Moments of Inertia of Composite figures.

UNIT – V

Kinematics and Kinetics of Particles:

Kinematics of particle: Rectiliner and Curvilinear motion – Projectile motion

Kinetics of Particle: Central force motion – Equations of Plane motion – Work Energy Principle – Application to particle motion

Text Books

1. Dr. R.K. Bansal, “Engineering Mechanics”, Laxmi Publications.
2. Shames & Rao, “Engineering Mechanics” Pearson Education.

References Books

1. S.S. Bhavikatti, “Engineering Mechanics”, New Age Publications.
2. Seshagiri Rao, “Engineering Mechanics”, University Press, Hyderabad.
3. B.Bhattacharyya, “Engineering Mechanics”, Oxford University Publications.

Course Title	Surveying				B. Tech. CE (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091102	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	4	0	0	4	40	60	100
Mid Exam Duration : 1.5Hrs					End Exam Duration : 3Hrs		

Course Objectives:

- Be familiar with Chain and Compass in measuring the horizontal and vertical distances, calculating simple areas and correcting different errors.
- Identify the level instruments; record the levels in field book and determine the reduced levels of objects by different methods.
- Determine the areas and volumes on the field by different rules and methods.
- Set out simple curves for different road conditions and also able to operate the Total Station instrument for measuring the distances, angles and areas.
- Understand the concepts of photogrammetry and remote sensing which can be used in higher surveying.

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

CO 1	Use the chain and compass for preliminary survey
CO 2	Determine the different levels by applying the levelling techniques.
CO 3	Compute areas and volumes on the field for different practical conditions.
CO 4	Understand and apply the concepts of curves and utilize the Total Station instrument for different practical field conditions.
CO 5	Know the concepts of Photogrammetry and Remote sensing

UNIT-I

Chain and Compass Surveying:

Chain surveying: Principles of Chain surveying; Basic definitions; Corrections - Obstacles – Problems.

Compass Surveying: Prismatic compass – Surveyor's compass – Meridians – Bearings – Magnetic dip and Declination – Compass Traverse – Local Attraction – Problems – Errors in Compass.

UNIT – II

Levelling: Basics – Different methods of levelling – Different types of level instruments – Levelling staff – Level field book – Reciprocal Levelling – Calculation of Reduced Levels by Rise and Fall Method and Height of Instrument Method – Related problems

UNIT – III

Areas: Computation of areas from filed notes & plotted figures – Methods of calculation of areas by Mid ordinate rule, Trapezoidal rule, Average ordinate rule and Simpson's rule.

Volumes: computation of volumes by straight volumes of level, Two level, Side hill two level section, Trapezoidal and Prismoidal rule - Computation of volumes of borrow pit by spot levels.

UNIT – IV

Curves: Principle of Simple & Compound curves – Setting out of Simple curves by offsets from Long chord, Rankine's One theodolite and Two theodolite methods – Reverse Curves & its components.

Total Station: Introduction – Functions – Principles – Handling & Setting of Total Station Instrument – Measuring of Horizontal and Vertical angles – Measuring of Areas by Total Station.

UNIT – V

Photogrammetry: Basic concepts – Perspective geometry of aerial photograph – Relief and Tilt displacements – Terrestrial Photogrammetry – Flight planning – Stereoscopy.

Remote Sensing: Introduction –Electromagnetic Spectrum - Interaction of electromagnetic radiation with the atmosphere and earth surface- Remote sensing data acquisition: platforms and sensors; Visual image interpretation;

Text books

1. Madhu, N, Sathikumar, R and Satheesh Gopi, "Advanced Surveying: Total Station, GIS, GPS and Remote Sensing", Pearson Education India, New Delhi
2. N. N. Basak, "Surveying & Levelling", Tata McGraw-Hill Companies, Inc. New York.

References Books

1. Bhavikatti, S.S, "Surveying and Levelling, Vol. I and II", I.K. International Publishing House Pvt. Ltd., New Delhi.
2. Arora, K.R, "Surveying, Vol-I, II and III", Standard Book House U-O Rajsons Publications Pvt. Ltd., New Delhi.

Course Title	Building Technology				B. Tech. CE (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091103	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	4	0	0	4	40	60	100
Mid Exam Duration : 2Hrs					End Exam Duration : 3Hrs		

Course Objectives:

- Understand the importance of construction management, resources and stages of Planning
- To know how to prepare scheduling in construction activity. significance of PERT and CPM and make use of these two techniques how to develop a network diagram for construction
- To know various types of equipment in construction and applications mechanisation in construction

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

CO 1	Investigate the various construction materials used the field/industry
CO 2	Describe different types of concrete mixes along with admixtures
CO 3	Understand various foundations, floorings, masonry works used in the construction field
CO 4	Understand concepts on lintels, arches, sunshades and types of roofs and form works
CO 5	Understand various plastering and painting works, water supply and sanitary arrangements in the building

UNIT – I

Building Materials-I: Bricks, Stones, Aggregate, Sand, Ordinary and Special Cements, Tiles, Wood, Paints, varnishes.

UNIT – II

Building Materials-II: Reinforced Cement Concrete, Ready Mixed Concrete, High Performance Concrete, Concrete and Mortar Admixtures, I.S.I. Standards and Laboratory Testing of Building Materials.

UNIT – III

Building Structures-I: Types of foundation, Stone masonry, brick masonry. Damp proof course, plinth beam, types of flooring.

UNIT – IV

Building Structures-II: Framed Structures, lintels, arches, sunshades, Types of roofs and roof coverings. Staircases, Form works, door, windows.

UNIT – V

Building Finishes: Plastering, Colour Washing, Distempers, Painting and Varnishing. Water Supply and Sanitary arrangements, Electrification and Weatherproof Courses.

Text Books

1. Rangwala, "Engineering Materials", Charotar Publishing House, Anand, Gujrat. .
2. M S Shetty "Concrete Technology", S. Chand Publishers, New Delhi.

Reference Books

1. S P Arora & S P Bindra, "Building Construction", Dhanpath Rai and Sons, New Delhi.
2. Sushil Kumar, "Building Construction", Standard Publishers Distributers, New Delhi.

Course Title	Estimating and Costing				B. Tech. CE (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091104	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 1.5 Hrs					End Exam Duration : 3Hrs		

Course Objectives:

- To know the importance of preparing the types of estimates under different conditions.
- To know about the rate analysis and bill preparations
- To emphasizes on preparation quantities of item of works with different methods and how to prepare bar bending schedule for structural elements
- To study about the specification writing
- To equip the student with the ability to do rate analysis, valuation of properties.

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

CO 1	Apply different types of estimates in different situations
CO 2	Apply different types of estimates in different situations
CO 3	Expertise the different methods of estimation of various item of work and expertise to prepare bar bending schedule.
CO 4	Demonstrate the concepts of specification writing
CO 5	Discuss agreements, contracts, tenders for building construction and carry out valuation of assets

UNIT - I

Introduction to the Estimation of Structures:

Introduction, Different Item of Works – Units of Item of Works – Types of Estimates – Methods of Estimates

UNIT – II

Rate Analysis

Rate Analysis of Different Item of Works: Earthwork Excavation – Mortars of Various Proportions (Cement and Lime) – Concrete with Various Proportions (Lime and Cement) – Brick Masonry – Stone Masonry – Pointing – Painting – Plastering – Aluminum Partitions – Wooden Partitions – Cement Concrete Flooring With 1:2:4 Mix – Ceramic and Vitrified Tile Flooring and Mosaic Flooring.

UNIT – III

Quantity Estimation of Buildings

Estimation of Quantities in Buildings: Load Bearing Wall Structure of Single Room, Double Room and Multi Room.

UNIT – IV

Specifications

Specification of Different Items of Works: Types - Standard Specifications for Different Items of Building Construction – Earth Work for Foundations, Mortars, Foundation Concrete, Reinforced Concrete, Brick Work, Stone Masonry, Mosaic Flooring, Terrazo Flooring, RCC Roof and AC Roof and GI Sheets, Plastering, Painting, Pointing and Wood Works.

UNIT – V

Contracts and Valuation

Contracts: Types of Contracts, Contract Document, Conditions of Contracts, Contract Procedure, Termination of Contracts, Specifications, Important Conditions of Contract, Arbitration and Tenders.

Valuation: Introduction, Technique of Valuation, Elements of Valuation and Factors Affecting Valuation, Methods of Valuation to the Land Property and Building Property, Mortgage.

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, Amaravathi.

Reference Books

1. Dr. Roshan H Namavati "Professional Practice", The Lakhani Book Depot, Mumbai.
2. S C Rangwala "Estimating Costing and Valuation", Charotar Publishing House Pvt. Limited, Anand.
3. Chakraborthi. M, Estimating, Costing, Specification & Valuation in Civil Engineering, UBS Publishers, and distributors, 2006.

Course Title	Water Supply Engineering				B. Tech. CE (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091105	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	4	0	0	4	40	60	100
Mid Exam Duration : 1.5Hrs					End Exam Duration : 3Hrs		

Course Objectives:

- To import knowledge in water quantity and quality parameters and future demand and 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	To understand the impact of development of water supply and estimation and design of public water supply.
CO 2	To interpret the sources, Quality and Standards of drinking water quality standards.
CO 3	To interpret water treating procedures and design of water treatment methods.
CO 4	To evaluate the advanced water treatment in removal of harmful constituents and water management.
CO 5	To evaluate the water distribution techniques and water distribution system, its working and plumbing.

UNIT – I

Introduction to Water Supply: Environmental Engineering - Role of Environmental Engineer - Water supply - Development of public water supply - Need for protected water supplies - Objectives of water supply systems - Water supply scheme - Quantity of water - Estimating requirements - Design period – Per Capita Consumption - Fluctuations in demand pattern - population forecast – Arithmetic, Incremental, Geometric methods.

UNIT – II

Sources, Quality and Standards of Water: Sources of water - Surface and ground water sources – Quality of water - Physical, chemical, and biological aspects - Analysis of water - Water quality standards - Impurities in water - Water borne diseases - Drinking water quality standards.

UNIT – III

Treatment of Water: Flowchart of water treatment plant - Treatment methods (Theory and Design) – Sedimentation - Coagulation - Sedimentation with Coagulation – Filtration - Chlorination and other Disinfection methods - Softening of Water – Defluorination - Removal of Odours.

UNIT – IV

Advanced Water Treatments and Management: Principles and functions of Aeration - Iron and manganese removal, Defluorination and demineralization -Water softening - Desalination - Membrane Systems - Recent advances. Sustainable Development - Rainwater harvesting methods - Water Pollution - Causes and effects

UNIT – V

Water Distributions and Plumbing: Distribution systems – Requirements, Layout of Water distribution systems - Design procedures- Hardy Cross and equivalent pipe methods service reservoirs – Joints, valves such as sluice valves, air valves, scour valves and check valves water meters – Laying and testing of pipelines – Pump house, waste detection and prevention, Principles of design of water supply in buildings - House service connection. Water supply – pipes and fittings; House drainage - Sanitary fittings, Traps, Plumbing system of drainage

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", Lakshmi Publications, 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.

Course Title	Construction Practice and Management				B. Tech. CE (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091106	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	4	0	0	4	40	60	100
Mid Exam Duration : 1.5Hrs					End Exam Duration : 3Hrs		

Course Objectives:

- Understand the importance of construction management, resource management and what the stages of construction activity are?
- To know how to prepare scheduling in construction activity. significance of pert and CPM and make use of these two techniques how to develop a network diagram for construction
- To know various types of equipment in construction and their usage in varied works usage of mechanization and its effect on productivity. Applications of machinery in different types of constructions are?
- Understand importance of inspection and how to maintain quality in different stages. Recognize the standards of materials and effective utilization of skilled persons in construction. Effect of ethical procedures in construction.
- To know the importance of safety measures in construction activity, effect of safety benefits to construction workers. Understand the importance of organization and know how to maintain communications in construction.

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

CO 1	To understand the characteristics of different power switches.
CO 2	To understand the single phase and three phase controlled rectifier with different loads
CO 3	To understand the operating principle of cyclo converters, choppers and inverters
CO 4	To understand harmonic content in output voltage and current waveforms of an inverter.

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 and New Techniques in Construction Management: Stages of Planning – Scheduling, Preparation of Material – Equipment – Labour and Finance Schedules – Bar Charts and Milestone Charts**.** Programme Evaluation Review Technique (PERT) and Critical Path Method (CPM) – Break Down of Structures – Classification of Activities – Rules for Developing Networks – Network Development and Analysis – Critical Activities – Critical Path and Cost Optimization.

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 and 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.

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.

Course Title	Soil Mechanics				Program & Sem.		Minor Degree
Course Code	Hours/Week			Credits	Maximum Marks		
2019107	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 1.5 Hours				End Exam Duration: 3 Hours			

Course Objectives:

- To impart the fundamental concepts of soil mechanics.
- To know the importance of index properties like grain size, consistency limits, soil classification.
- To understand the permeability and seepage through soils.
- To understand the concept of compaction, consolidation of soils and shear strength.

Course Outcomes:

On completion of the course, the student will be able to:

CO 1	Identify and tabulate different types of soils and their properties.
CO 2	Calculate and illustrate the permeability characteristics of soils, seepage quantities and pore water pressures below the ground.
CO 3	Analytically compute the vertical stress in a semi-infinite soil mass due to various loading conditions.
CO 4	Understand and interpret the compaction curve with compaction effort, soil type and the basic mechanism of consolidation of soils.
CO 5	Determine the shear strength parameters by analytically and graphically for various geotechnical problems.

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.

UNIT - III

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

UNIT - IV

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.

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">Circuit Theory</td><td colspan="3">B. Tech. EEE (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">20MD201</td><td rowspan="2">Professional Core Course (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>4</td><td>0</td><td>0</td><td>4</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: This course introduces the concepts of circuit analysis which includes D.C. and A.C excitations, various Network functions, synthesis and various types of filters.</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="7">To impart knowledge on applying various laws, selecting appropriate and relevant techniques for solving DC and AC electrical circuits</td></tr>
<tr><td>CO 2</td><td colspan="7">To describe network functions for various electrical circuits</td></tr>
<tr><td>CO 3</td><td colspan="7">To analyze various networks using different methods</td></tr>
<tr><td>CO 4</td><td colspan="7">To derive various filter characteristics</td></tr>
</table>

UNIT - I

DC Circuits:

Introduction, Electrical circuit elements (R, L & C),Voltage and current sources(Independent & Dependent),Source transformation, Network reduction techniques for simple Series & Parallel networks, Kirchhoff's current laws, Kirchhoff's voltage laws, Mesh and Nodal analysis of simple circuits with DC, Simple Problems.

UNIT - II

AC Circuits:

Representation of sinusoidal waveforms, average, peak and RMS values, Form factor Peak factor for sinusoidal waveform, Phasor - Phasor representation, Impedance, Admittance, Reactance, Susceptance, Real power, Reactive power, Apparent power, power factor, Simple Problems.

UNIT - III

Network Functions: Single port and multiport networks, Immittance functions of two port parameters, Necessary conditions for driving point and transfer functions. Poles and Zeros, Time domain response from pole zero plots, Restrictions from pole zero locations.

UNIT - IV

Network Synthesis:

Introduction, Definition, Necessary and sufficient conditions for a function to be positive real, Elements of circuit synthesis, Foster and cauer forms of LC Networks, Synthesis of RC and RL networks.

UNIT - V

Filters:

High-pass, low-pass, band-pass and band-stop L-C filters. Derivation of expression for propagation constant, attenuation constant, phase shift constant, cut-off frequency, characteristics impedance etc. for constant k and m-derived filters.

Text Books

1. Network Analysis – Van Valkenburg - 3rd edition, PHI.
2. Network Analysis - G.K. Mittal, Khanna Publishers

References Books

1. Circuits & Networks – A. Sudhakar, Shayammohan. S. Pillai, 4th Edition – TMH.
2. Networks and Systems – D. Roy Chowdari – New Age International
3. Electrical Circuits - N. Sreenivasulu, Reem publications.

<table>
<tr><td>Course Title</td><td colspan="5">Basics of Electrical Measurement & Instrumentation</td><td colspan="3">B. Tech. EEE (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">20MD202</td><td rowspan="2">Professional Core Course (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>4</td><td>0</td><td>0</td><td>4</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration: 2Hrs</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: To introduce the basic principles of all measuring instruments. To deal with the measurements of voltage, current, power factor, power, energy and magnetic measurements. To understand the basic concepts of smart and digital metering.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand the different types of measuring instruments, their construction, operation and characteristics.</td></tr>
<tr><td>CO 2</td><td colspan="8">Identify the instruments suitable for typical measurements.</td></tr>
<tr><td>CO 3</td><td colspan="8">Apply the knowledge about transducers and instrument transformers to use them effectively.</td></tr>
<tr><td>CO 4</td><td colspan="8">Apply the knowledge of smart and digital metering for industrial applications.</td></tr>
</table>

UNIT - I

Introduction to Measuring Instruments:

Classification-deflecting, control and damping torques-ammeters and voltmeters-PMMC, moving iron type instruments- expression for the deflecting torque and control torque-errors and compensations, extension of range using shunts and series resistance.

UNIT - II

Potentiometers:

Principle operation of DC Crompton's potentiometer-standardization-measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization-applications.

Instrument Transformers:

CTs and PT s – ratio and phase angle errors.

UNIT - III

Measurement of Power:

Single phase dynamometer wattmeter, LPF and UPF, Double element and three elements dynamometer wattmeter, expression for deflecting and controlling torques.

Measurement of Energy: Single phase induction type energy meter – driving and braking torques – errors and compensations.

UNIT - IV

DC Bridges:

Method of measuring low, medium and high resistance – sensitivity of wheat-stones bridge - Kelvin's double bridge for measuring low resistance, measurement of high resistance.

AC Bridges:

Measurement of inductance -Maxwell's bridge, Anderson's bridge- Measurement of capacitance and loss angle-Desauty's bridge - Schering Bridge.

UNIT - V

Transducers:

Definition of Transducers, classification of Transducers, advantages of electrical Transducers, characteristics and choice of Transducers, principle and operation of LVDT, LVDT applications, Strain Gauge and its principle of operation, gauge factor. Introduction to smart metering.

Text books

1. G.K.Banerjee, Electrical and Electronic Measurements, PHI Learning Pvt.Ltd., 2nd Edition, 2016
2. S.C.Bhargava, Electrical Measuring Instruments and measurements, BS Publications, 2012.

References Books

1. A.K.Sawhney, Electrical and Electronic Measurement and Instruments, Dhanpat Rai and Co. Publications, 2005
2. R.K.Rajput, Electrical and Electronic Measurement and Instrumentation, S.Chand and Company Ltd., 2007.
3. Reissland, M.U.Electrical Measurements: Fundamentals, Concepts, Applications, New Age international (P) Limited publishers, 1st Edition 2010.
4. E.W.Goloding and F.C.Widdis, Electrical Measurements and Measuring Instruments , fifth edition, wheeler publishing, 2011.

<table>
<tr><td>Course Title</td><td colspan="5">Electrical Machines</td><td colspan="3">B. Tech. EEE (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">20MD203</td><td rowspan="2">Professional Core Course (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>4</td><td>0</td><td>0</td><td>4</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: The objective of the course is to learn principle of operation, construction, Starting methods, characteristics and performance of various electrical machines.</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="7">Understand the construction Principle of operation of various electrical machines.</td></tr>
<tr><td>CO 2</td><td colspan="7">Illustrate starting methods of various electrical machines.</td></tr>
<tr><td>CO 3</td><td colspan="7">Analyze the characteristics, phasor diagrams of various electrical machines.</td></tr>
<tr><td>CO 4</td><td colspan="7">Determine the losses and efficiency by conducting suitable tests.</td></tr>
</table>

UNIT - I

DC Generators:

Working principle – Construction – Classification – EMF equation – Characteristics of DC Shunt Generators – Numeric problems.

DC Motors:

Principle of operation – Torque expression – Characteristics – Speed control of DC Shunt motor – 3 point and 4 point starters - Numerical problems.

UNIT - II

Single Phase Transformers:

Construction – Principle of operation – Types- EMF equation – transformer operation on no-load and load - Phasor diagrams – Equivalent circuit – losses – efficiency and regulation – OC and SC tests – Auto transformers – Numerical problems. Three phase transformer connections.

UNIT- III

Three Phase Induction Motors:

Construction – types – production of rotating magnetic field – principle of operation – slip, rotor parameters at stand still and running condition – torque equation – Slip-Torque characteristics – Numerical problems.

UNIT - IV

Single Phase Induction Motors:

Construction – Double revolving field theory – principle of operation – equivalent circuit – determination of equivalent circuit parameters using No-load and Blocked rotor tests – Starting Methods.

UNIT - V

Synchronous Machines:

Construction – types – winding factor – EMF equation –phasor diagrams – equivalent circuit – OC and SC tests – Regulation by Synchronous impedance method – numeric problems.

Synchronous motors:

Principle of operation – Starting methods.

Text Books

1. Electrical Machines – I.J. Nagrath & D.P. Kothari – TMH Publications.
2. Electrical Machinery – Dr.P. S. Bimbra – Khanna Publishers.

Reference Books

1. Electrical Machines – J.B. Gupta – Kataria publications.
2. Electrical Machinery – A.E. Fitzgerlad, C. Kingsley & S. Umlauts – TMH Publications

<table>
<tr><td>Course Title</td><td colspan="4">Principles of Power Systems</td><td colspan="3">B. Tech. EEE (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">20MD204</td><td rowspan="2">Professional Core Course (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>4</td><td>0</td><td>0</td><td>4</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: Student is able to learn the types of Generating stations, Mechanical considerations and parameters, Performance of Transmission lines, Substations.</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="7">Draw the layout of hydro power plant, thermal power station. explain its operation</td></tr>
<tr><td>CO 2</td><td colspan="7">Determine various mechanical parameters of transmission lines</td></tr>
<tr><td>CO 3</td><td colspan="7">Analyze various calculations regarding line constants.</td></tr>
<tr><td>CO 4</td><td colspan="7">Evaluate the performance of Transmission line</td></tr>
<tr><td>CO 5</td><td colspan="7">Understand the different types of sections in Substations and types of substations.</td></tr>
</table>

UNIT - I

Electric Power Generating Stations:

Electric Power System – Sources of Electrical Energy – Generation, Transmission and Distribution of Electric Power-Schematic Arrangement of Different Power Plants like Hydro, Thermal, Solar and Wind.

UNIT - II

Mechanical Design of Transmission Lines:

Overhead– Main Components of Overhead Lines – Conductor Materials – Line Supports – Insulators – String Efficiency – Corona Effect – Sag and Calculation of Sag in Overhead Transmission Line.

UNIT - III

Electrical Design of Transmission Lines:

Resistance in Transmission Line – Skin Effect– Flux Linkage in Current Carrying Conductors – Inductance of a Single Phase and Three Phase Lines. Capacitance of a Single and Three Phase Transmission Line.

UNIT - IV

Electrical Distribution Systems:

Classification of Distribution Systems - Comparison of DC Vs AC – comparison of Under Ground Vs Over - Head Distribution Systems.

Design Considerations of Distribution Feeders:

Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution systems.

UNIT - V

Substations:

Location of Substations, Substations Layout Showing the Location of all the Substation Equipment. Bus-bar arrangement in the substations with Relevant Diagrams.

Text Books

1. Generation & utilization of Electrical Energy, C. L. Wadhwa New age International (P) Limited, Publishers 1997.
2. Electrical Power Systems, C. L. Wadhwa New age International (P) Limited, Publishers 1997.

Reference Books

1. Electrical Power Generation, Transmission and Distribution, S.N. Singh, PHI, 2003.
2. Principles of Power Systems, V.K Mehta and Rohith Mehta S. Chand & Company Ltd, New Delhi, 2004.
3. A Text Book on Power System Engineering, L. Soni, P. V. Gupta, U. S. Bhatnagar and A. Chakrabarthi , Dhanpat Rai & Co. Pvt. Ltd, 1999.

<table>
<tr><td>Course Title</td><td colspan="4">Linear Control Engineering</td><td colspan="3">B. Tech. EEE (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">20MD205</td><td rowspan="2">Professional Core Course (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>2</td><td>0</td><td>0</td><td>2</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: The objective of the course is to learn mathematical modeling of physical systems, electrical systems, time response of first order and second order Systems, stability analysis using time domain and frequency domain and design compensator in frequency domain to improve the performance.</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to:</td></tr>
<tr><td>CO 1</td><td colspan="7">Understand modeling of physical systems, time and frequency domain specifications and stability of the system.</td></tr>
<tr><td>CO 2</td><td colspan="7">Analyze the stability of the system in time and frequency domains.</td></tr>
<tr><td>CO 3</td><td colspan="7">Block diagram construction and evaluate the transfer function using signal flow graph, steady state error and static error constants.</td></tr>
<tr><td>CO 4</td><td colspan="7">Design lag, lead compensators in frequency domain.</td></tr>
</table>

UNIT - I

Control System Concepts:

Introduction to control systems, classification, transfer function, mathematical modeling of physical systems, block diagram, signal flow graphs and mason's gain formula.

UNIT - II

Time Domain Analysis:

Standard test signals, time response of first and second order systems- time response specifications, steady state error and error constants.

UNIT - III

Concept of Stability and Root Locus:

The concept of stability, necessary conditions for stability – Routh Hurwitz's criterion – limitations of Routh's stability – Root locus concept – construction of Root loci - Effect of Poles & Zeros on stability.

UNIT - IV

Frequency Domain Analysis:

Introduction, frequency domain specifications, bode plots, gain and phase margin.

UNIT - V

Compensation Techniques:

System design and compensation – realization of basic lag and lead compensations in frequency domain.

Text Books

1. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 5th edition, 2007.
2. Automatic Control Systems by B. C. Kuo and Farid Goinaraghi – John Wiley and Sons, 8th edition, 2003.

Reference Books

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. Control Systems Engineering by NISE, 5th edition, John Wiley.
3. Control Systems by A. Anand Kumar, Prentice Hall of India Pvt. Ltd.

<table>
<tr><td>Course Title</td><td colspan="4">Principles of Power Electronics</td><td colspan="3">B. Tech. EEE (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">20MD206</td><td rowspan="2">Professional Core Course (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>2</td><td>0</td><td>0</td><td>2</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="3">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: The course is oriented to the study of power electronics devices, the analysis and describes the main industrial applications. The objectives include: 1) to know the principles of power electronics, 2) to classify the different kinds of power electronics circuits as a function of the input source and loads.</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="7">To understand the characteristics of different power switches.</td></tr>
<tr><td>CO 2</td><td colspan="7">To understand the single phase and three phase controlled rectifier with different loads</td></tr>
<tr><td>CO 3</td><td colspan="7">To understand the operating principle of cycloconverters, choppers and inverters</td></tr>
<tr><td>CO 4</td><td colspan="7">To understand harmonic content in output voltage and current waveforms of an inverter.</td></tr>
</table>

UNIT - I

Fundamentals of Power Semi-conductor devices:

SCR – static characteristics –turn on and off mechanism – MOSFET, IGBT, GTO Characteristics.

UNIT - II

Phase controlled Rectifiers(AC to DC):

Phase controlled rectifiers – single phase half and fully controlled converters – midpoint and bridge connections with R and RL loads – effect of source inductance- three phase half controlled converters with R load .

UNIT - III

AC Voltage Controllers (AC to AC):

AC voltage controllers- single phase ac voltage controllers with SCR for R and RL load – cyclo converters – single phase cyclo converters (mid-point configuration) with R load.

UNIT - IV

Choppers (DC to DC):

Choppers – principle of operation – control strategies- types of chopper circuits – type A, type B- buck -boost converter.

UNIT - V

Inverters (DC to AC):

Inverters – single phase half bridge and full bridge inverters with R and RL load –output voltage control techniques - PWM techniques- harmonic reduction techniques.

Text Books

1. Power Electronics –M.D Singh & K.B. Kanchandhani, TMH publications, 1998.
2. Power Electronics - Circuits, Devices and Applications –M.H. Rashid, Prentice Hall of India, 2nd Edition 1998.

Reference Books

1. Power Electronics- P.S. Bimbhra, Khanna Publications.
2. Power Electronics –Vedam Subramanyam, New Age Information Limited, 3rd Edition.
3. Power Electronics –V.R. Murthy, Oxford University Press, 1st Edition – 2005.
4. Power Electronics –P.C Sen, Tata Mc Graw Hill Publishing.

Course Title	Material Science and Engineering					B.Tech ME(MINOR)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20MN301	**ESC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 90 Minutes						**End Exam Duration: 3Hrs**		

Course Objectives:

- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams.
- Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints.
- Explain the methods to change the properties of materials through heat treatment processes
- Familiarize properties and applications of ceramics, polymers and composite materials.
- Demonstrate the fundamental properties of nano-materials and their applications.

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

CO 1	Understand the importance of iron - iron carbide phase diagram
CO 2	Understand the importance of non-ferrous metals and alloys in engineering applications.
CO 3	Explain the principles of binary phases
CO 4	Utilize nonferrous metals and alloys in engineering.
CO 5	Understand the importance of Heat Treatment.

UNIT-I

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-Iron-carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

UNIT-II

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Microstructure, properties and applications of alloy steels- stainless steels and tool steels.

Cast irons: Microstructure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT-III

Heat Treatment of Steels**:** Annealing, tempering, normalizing and hardening, isothermal transformation diagrams for Fe-Fe3C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening - carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

UNIT-IV

Non-ferrous Metals and Alloys: Microstructure, properties and applications of copper, aluminium, titanium, nickel and their alloys. Study of Al-Cu phase diagram

UNIT-V

Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.

Text Books:

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. R.Balasubramaniam, Callister's Material Science and Engineering, 2/e, Wiley India, 2014.
3. Introduction to Material science by Barry Royce Schlenker
4. Engineering material Science by Milton Ohring

Reference Books:

1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
3. L.H.VanVlack, Elements of Material Science and Engineering, 6/e, Pearson Education,2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

Course Title	Thermodynamics					B.Tech ME (MINOR)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20MN302	PC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	--	3	40	60	100
Mid Exam Duration:90 Minutes					End Exam Duration: 3Hrs			

Course Objectives:

. The students completing this course are expected:

- Concepts of heat, work, energy and governing rules for conversion of one form to other.
- Applications of I & II law of thermodynamics.
- To understand concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- To familiarize steam properties to understand working of steam power plants.
- To familiarize psychometric properties to understand working of Refrigeration and Air conditioning systems.

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

CO 1	Describe the thermodynamic system, control volume, thermodynamic properties, thermodynamic equilibrium and energy transfer in the form of heat and work in various applications.
CO 2	Analyze how energy transformation occurs from one form to another in open and closed systems and able to apply Steady Flow Energy Equation to various engineering devices.
CO 3	Identify the major difference in the working of a heat engine, heat pump and a refrigerator and execute the calculations of their efficiencies.
CO 4	Evaluate entropy changes in wide range of processes and determine the reversability and irreversability of a process from such calculations.
CO 5	Judge the properties of pure substances and familiarize with psychometric properties to understand the working of refrigeration and air conditioning systems.

UNIT-I

Basic Concepts and Definitions: Classical and statistical thermodynamics, definitions of thermodynamic terms, quasi – static process, point and path functions, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.

Work and Heat: Non flow (P.dV) or displacement work in various reversible processes, Heat Transfer, comparison of work and heat.

UNIT-II

First Law of Thermodynamics: First law for a closed system undergoing a cycle and for a process, Joules experiment, PMM-I.

First Law Applied to Non-Flow and Flow Process, Corollaries and limitations of First Law of Thermodynamics. Simple problems.

UNIT-III

Second Law of Thermodynamics: Kelvin-Plank statement, Clausius statement, equivalence of Kelvin-plank and clausius statements, Heat engine, heat pump and refrigerator, reversibility and irreversibility, Carnot Cycle, Carnot's Theorem, PMM-II - simple problems.

UNIT-IV

Entropy: Clausius theorem, Definition of entropy, principle of entropy increase, T-s plot, change in entropy in various reversible processes.

Availability & Irreversibility: Definition of; exergy and energy, Availability in steady flow, non-flow processes and irreversibility.

UNIT-V

Properties of Steam : Formation of steam form ice to super-heated steam with reference to T-V, P-V & T-S diagrams, properties of steam, Quality of steam, expressions for the change in internal energy, enthalpy, work, heat, entropy in various processes, Use of steam Tables and Mollier's chart. Simple problems.

Psychometry

Definitions of - Dry Bulb temperature, Wet-Bulb Temperatures, Specific humidity (or) Humidity Ratio, Dew Point Temperature, Degree of Saturation, Relative Humidity, Sensible Heating, Sensible cooling, Humidification and Dehumidification. Measurement of psychometric properties using psychometric chart. Simple Problems.

Text Books:

1. P.K. Nag Engineering Thermodynamics, 6th Edition 2019 Tata McGraw Hill, New Delhi.
2. Cengel, Thermodynamics – An Engineering Approach, 6th Edition 2019 Tata McGraw Hill, New Delhi.
3. V. Babu, Fundamentals of Engineering Thermodynamics, 2019

Reference Books:

1. B.P Mistra, Engineering Thermodynamics. .
2. Thermodynamics – Yadav" Central Publishers
3. E. Ratha Krishna, Fundamentals of Engineering Thermodynamics, PHI Publishers, New Delhi.

Course Title	KINEMATICS OF MACHINERY				B. Tech. ME (MINOR)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
20MN303	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To understand the terms, types, and design related to mechanisms.
- To perform kinematic analysis on various mechanisms.
- To draw the cam profile to study about types of cams and cam terminologies. To know kinematics of gears.

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

CO 1	Design a suitable mechanism depending on application
CO 2	understand the working principles of common mechanisms
CO 3	Analyze mechanism for finding its displacement, velocity, acceleration,
CO 4	understand different types of motions and various configurations of followers, by drawing

UNIT – I

Mechanisms and Machines:

Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs sliding, turning, rolling, screw and spherical pairs , lower and higher pairs , closed and open pairs .Constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines: classification of mechanisms and machines, kinematic chain, inversion of Mechanisms: inversions of quadric cycle chain, single and double slider crank chain. Mobility of mechanisms

UNIT - II

Straight Line Motion Mechanisms:

Exact and approximate, copiers and generated types –Peaucellier, Hart and Scott Russel – Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph

Steering Mechanisms: Conditions for correct steering – Davis Steering gear, Ackermanns steering gear.

UNIT - III

Kinematics:

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, and determination of Coriolis component of acceleration. Kleins construction. Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method

Instantaneous Centre Method: Instantaneous centre of rotation, three centres in-line theorem – locating instantaneous centres for simple mechanisms and determination of angular velocity of points and links.

UNIT-IV

CAMS

Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes and Drawing of cam profiles .

UNIT-V

Gear Trains

Higher pairs, friction wheels and toothed gears types, law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth: cycloidal and involute profiles, Velocity of sliding, phenomena of interference.

Gear Trains:

Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile

Text Books:

1. S.S. Rattan , Theory of Machines , Tata McGraw Hill Publishers, 4th Edition, 2015.
2. Thomas Bevan, Theory of Machines, Pearson (P) 3rd Edition, 2012
3. Theory of machines and Mechanisms, J.J Uicker, G.R.Pennock & J.E. Shigley – Oxford publishers.4th Edition, 2015
4. The Kinematics of Machinery: Outlines of a Theory of Machines by Franz Reuleaux, Eugene S. Ferguson Published December 19th 2012 by Dover Publications

Reference Books:

1. Theory of Machines by Sadhu Singh & Pearson (P).
2. R.L Norton , Kinematics and dynamics of machinery, Tata McGraw Hill Publishers,2012
3. Mechanisms and Dynamics of Machinery Hardcover – Import, 11 by Hamilton H. Mabie (Author), Charles F. Reinholtz (Author) February 1987
4. Kinematics and Dynamics of Machines by G. H. Martin (Author) 1 May 2002

Course Title	INSTRUMENTATION AND CONTROL SYSTEMS				B. Tech. ME (MINOR)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
20MN304	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To enable the students to understand the fundamentals of instrumentation and control available for monitoring/measuring in domestic / industrial applications.
- To learn fundamentals of various types of Transducers.
- To acquire basic understanding of principle & working of Transducers

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

CO 1	select appropriate device for the measurement of parameters like temperature, pressure, speed, stress, humidity, flow velocity etc., and justify its use through characteristics and
CO 2	Analyze the fundamentals of various types of Transducers.
CO 3	Implement various principles & working of Transducers
CO 4	understand the methods to analyze the stability of systems from transfer function forms.

UNIT-I

Introduction

Definition - Basic principles of measurement - Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics sources of error, Classification and elimination of error.

UNIT-II

Measurement of Displacement:

Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, calibration procedures

Measurement of Temperature: Classification - Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers - Temperature Indicators.

Measurement of Pressure: Units - classification - different principles usedManometers, Piston,
Bourdon pressure gauges, Bellows - Diaphragm gauges. Low pressure measurement - Mcleod pressure gauge

UNIT -III

Measurement of Level: Direct method - Indirect methods - capacitative, ultrasonic, magnetic, cryogenic fuel level indicators - Bubler level indicators. FLOW MEASUREMENT: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer Laser Doppler Anemometer (LDA).
Measurement of Speed: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer. Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

UNIT -IV

Measurement of Stress & Strain: Various types - electrical strain gauge – gauge factor - method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque.

UNIT - V

Measurement of Humidity - Moisture content in the gases, sling psychrometer, Absorption psychrometer, Dew point meter
Measurement of Force, Torque And Power- Elastic force meters, load cells, Torsion meters, Dynamometers.
Elements Of Control Systems: Introduction, Importance - Classification – Open and closed systems

Text Books:

1. Doeblin O. etaI., Measurement systems: Application and design, , TMH 6th edition. 2. Beckwith, Marangoni, Linehard ,Mechanical Measurements , PHI, PE
2. B.C.Nakra & K.KChoudhary, Instrumentation, Measurement & Analysis, TMH,2nd edition2004
3. R.K. Jain ,Mechanical and Industrial Measurements , Khanna Publishers.
4. Instrumentation and Control Systems 1st Edition - June 3, 2004 Author: William Bolton

Course Title	Heat Transfer					B.Tech ME (MINOR)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20MN305	PCC	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:

- Understand different modes of heat transfer
- Gain knowledge about natural and force convection phenomenon
- Estimate experimental uncertainty in measurements
- Design heat and mass transfer equipment.
- Evaluate no. of stages required for given mass transfer problem.

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

CO 1	Apply the Basic laws of Heat transfer.
CO 2	Analyze the use of conductive heat tranfer and insulation.
CO 3	Apply the Knowldge of Fluid flow and themal flow of Convective Heat transfer.
CO 4	Evaluate the loss of thermal radiation.
CO 5	Compare different heat exchangers.

UNIT -I

Introduction: Basic modes of heat transfer- rate equations- generalized heat conduction equation - steady state heat conduction solution for plain and composite slabs - cylinders - critical thickness of insulation- heat conduction through fins of uniform cross section- fin effectiveness and efficiency.

Unsteady State Heat Transfer Conduction- Transient heat conduction- lumped system analysis and use of Heisler charts.

UNIT -II

Convection: Basic concepts of convection–heat transfer coefficients - types of convection – forced convection and free convection.

Free Convection -development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation

Forced convection: external flow–concepts of hydrodynamic and thermal boundary layer- use of empirical correlations for flow over plates and cylinders. Fluid friction– heat transfer

analogy, approximate solution to laminar boundary layer equation for external flow. Internal flow – Use of empirical relations for convective heat transfer in horizontal pipe flow.

UNIT-III

Radiation: Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies – shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect.

Design of Heat Transfer Equipment's:

General design of heat exchange equipment, heat exchangers, condensers, boilers, types of evaporators.

UNIT-IV

Heat Exchangers: Types of heat exchangers- parallel flow- counter flow- cross flow heat exchangers- overall heat transfer coefficient- LMTD and NTU methods- fouling in heat exchangers.

UNIT-V

Boiling and Condensation: Different regimes of boiling- nucleate, transition and film boiling condensation - filmwise and dropwise condensation.

Mass Transfer: Introduction **of** Conservation laws and constitutive equations - Fick's law of diffusion, isothermal equi-mass - Equimolal diffusion- - diffusion of gases and liquids- mass transfer coefficient.

Text Books:

1. P.K. Nag, Heat Transfer, 3/e, Tata McGraw-Hill, 2011.
2. J.P.Holman, Heat Transfer, 9/e, Tata McGraw-Hill,2008.
3. S. C. Arora& S. Domkundwar , A Course in Heat and Mass Transfer,DhanpatRai& CO.(P) LTD-Delhi , 2007.

Reference Books:

1. F. P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6/e, John Wiley, 2007.
2. Cengel. A.Yunus, Heat Transfer- A Practical Approach, 4/e, Tata McGraw-Hill, 2007.
3. S.P. Sukhatme, A Textbook of Heat Transfer, Universities Press, 2005
4. Lienhard and Lienhard, A Heat and Mass Transfer, Cambridge Press, 2011.
5. C.P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer databook, New Age Publications, 2014.
6. Lienhard and Lienhard, A Heat and Mass Transfer, Cambridge Press, 2011.

Course Title	DESIGN OF MACHINE ELEMENTS - II				B. Tech. ME (MINOR)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
20MN306	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

The student will learn

1.To study the design of of various springs

2 To study the design of sliding & ball, roll bearings3.To study the design of transmission of belts

4.To study the design of spur & helical gears

5. To study the design of various engine parts

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	understand the Design of various of springs
CO 2	knowledge the principles of working of ball &roller bearings
CO 3	Apply the different types of spur& helical gears ,various load calculations.
CO 4	Analyze the design of various engine parts
CO5	Evaluate different engine parts

UNIT – I

Mechanical Springs: Introduction - classification- design of helical compression Springs fatigue loading – Coaxial springs- Natural frequency of helical springs-Energy storage capacity Fatigue loading- Leaf springs.

UNIT – II

Bearings: Introduction-Types of Journal bearings – Lubrication – Bearing Modulus– bearingmaterials – Sliding contact bearing design. **Bearings:** Introduction- materials – Sliding contact bearing design.

Curved Beams : Bending stresses in curved beams

UNIT – III

Rolling Contact Bearings: Introduction -Ball and roller bearings – Static anddynamic loading of ball &roller bearings, bearing life –Failure of bearings.

Flexible Tranamission Elements - Design of flat belts- open & cross

UNIT IV

Spur & Helical Gears: Introduction to gears-Nomenclature of Spur and helical gears force analysis- law of gearing-Design analysis of spur gears –Lewis equation-Estimation ofcentre distance, module and face width, Check for dynamic and wear load considerations.

Design analysis of helical gears –Lewis equation-Estimation of centre distance, module and face width, Check for dynamic and wear load considerations.

UNIT – V

Engine Parts: Introduction to IC Engines parts -Forces acting on piston –design of piston,cylinder and cylinder liners, Connecting rod: Thrust in connecting rod – stress due to whipping action on Connecting rod ends.

Text Books:

1. Theory of machines, Khurmi, S.Chand.
2. Theory of machines, Thomas Bevan.
3. Dynamics of Machinery, by Hans Dresig
4. Theory Of Machines And Mechanisms By John J. Uicker, Gordon E. Shigley

Reference Books:

1. Theory of Machines, R.K.Bansal, J.S.Brar, Lakshmi Publications
2. Kinematics and Dynamics of Machines by G. H. Martin (Author) , Waveland Pr Inc; 2nd edition (1 May 2002)
3. Kinematics and Dynamics of Machinery by Charles E. Wilson, J. Peter Sadler
4. Dynamics of machinery by Alfred R. Holowenko

Course Title	METROLOGY				B. Tech. ME (MINOR)		
Course Code	Hours/Week			Credits	Maximum Marks		
20MN307	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	4	0	0	4	40	60	100
Mid Exam Duration : 1.5 Hrs					End Exam Duration : 3Hrs		

Course Objectives:

The student will learn to

1. Inspection of engineering parts with various precision instruments.
2. Design of part, tolerances and fits.
3. Principles of measuring instruments and gauges and their uses.4.Evaluation and inspection of surface roughness.
5. Inspection of spur gear and thread elements machine tool testing to evaluate machine tool quality

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

CO 1	understand the Limits, Fits and Tolerances, Indian standard system
CO 2	know the principles of working of the most commonly used instruments for measuring linearand angular distances
CO 3	Apply different types of Comparators, optical measuring instruments, flatness measurement methods and measuring methods of surface roughness
CO 4	Analyze Screw thread elements and measuring methods, Gear tooth profile measurement,CMM, Alignment tests on lathe, milling and drilling machine tools.

UNIT – I

Systems Of Limits And Fits: Introduction, Definitions, fits and their types –unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly.

UNIT – II

Linear Measurement: Length standard, line, ends & wavelength standards slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

Measurement of Angles And Tapers: Different methods – Bevel protractor – anglegauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

LIMIT GAUGES: Plug, Ring, Snap, Gap, Taper, Profile and Position gauges. Taylor's principleDesign of Go and No Go gauges.

UNIT – III

Optical Measuring Instruments: Tool maker's microscope – collimators, opticalprojector – optical flats and their uses, interferometer.

Flatness Measurement: Measurement of flatness of surfaces – straight edges–surfaceplates – optical flat and auto collimator.

Surface Roughness Measurement: Differences between surface roughness and surface waviness- Numerical assessment of surface finish – CLA, R.M.S Values – Ra ,Rz

UNIT- IV

Screw Thread Measurement: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.

Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling,portabl radial drilling machine tools.

UNIT -V

Gear Measurement: Gear measuring instruments, Gear tooth profile measurement: Measurement of diameter, pitch, pressure angle and tooth thickness. Coordinate Measuring Machines: Types of CMM and Applications of CMM.

Measurement Through Comparators: Comparators – Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses

Text Books:

1. Engineering Metrology, R.K. Jain, Khanna Publ.
2. Fundamentals of Dimensional Metrology, Connie Dotson, 4e, Thomson
3. Measurement & instrumentation, Alan S. Morris, Reza Langari
4. Industrial Metrology Surfaces and Roundness, Graham T.Smith

Reference Books:

1. Engineering Metrology , Mahajan, Dhanpat Rai
2. Handbook of Tribology: Materials, Coatings, and Surface Treatments, Bharat Bhushan and B.K.Gupta.
3. Surface Engineering with Lasers, Dehosson J.T.
4. Surface Engineering for corrosion and wear resistance, JR Davis, Woodhead Publ

Course Title	Computer Aided Design				B.Tech ME (MINOR)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
20MN309	PCC	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 Objective:

- The course examines the area that is commonly referred to as CAD/CAM
- The general objectives of the course are to enable the students Model the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings,
- Understand the basic analytical fundamentals that are used to create and manipulate.
- Understand the possible applications of the CAD/CAM systems in motion analysis, structure analysis, optimization, rapid prototyping, reverse engineering and virtual engineering.
- Understand concept of Group Technology, FMS and CIM

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

CO 1	Understand Fundamentals, Computer peripherals, Applications and benefits of CAD .
CO 2	Solve various Line generation, transformations, windowing and clipping concepts
CO 3	Analyze various curve generation concepts. wireframe, surface, solid modelling, CSG,B-rep, CSG, Bezier curve and surface representations
CO 4	Understand GT,FMS,Applications of robots in manufacturing and material handling
CO 5	Identify Various CAPP.MRP. capacity planning. Automatic identification methods, barcode technology concepts.

UNIT-I

Fundamentals of CAD - design process - Applications of computers for design benefits of CAD - Computer peripherals for CAD - Design work station.

Computer Graphics:

Raster scan graphics coordinate system, database structure for graphics modeling, Transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT-II

Geometry and line generation, Computer graphics: Transformations- Points and lines transformation - Translation, rotation, Scaling, Mirror Reflection; 2D and 3D transformations -Windowing and Clipping.

UNIT-III

Curve generation - Plane curves - Space curves - Surface description and generation; modeling concepts: 2D and 3D modeling - Wire frame, Surface and Solid modeling. B-rep solid modeling and constructive solid geometry, Bezier curve and surface representations.

UNIT-IV

CAM - Definition, Divisions of CIM: Group technology - Introduction, concepts of GT, Analysis of GT, Classification and coding system, Advances of GT, Flexible manufacturing systems (FMS) - Definition, Different flexibilities Need of FMS, Components of FMS, system and FMS, Advantages of FMS. Applications of robots in manufacturing and material handling.

UNIT-V

Computer Aided Process Planning- Variant and Generative CAPP Systems. MRP- Inputs and outputs of MRP, Capacity Planning Basic concepts of Shop floor data- Types of factory data and collection systems- concepts of automatic identification methods- Bar code technology-Concepts and uses.

Text Books:

1. CAD/CAM, A Zimmers& P.Groover, PE, PHI ,2012
2. Computer-Aided Design and Manufacturing 1st Edition (English, Paperback, E. Zimmers, M. Groover). 2010.
3. Introduction to Automated Process Planning" by T C Chang and R A Wysk. 2012
4. CAD/CAM By Ibrahim Zeid ,R.siva subramanyam ,Mcgraw Higher Ed.

Reference Books:

1. Computer Graphics :PlastockSchaum Series,2006
2. Interactive Computer Graphics: Newman &Sproul,2012
3. Computer Graphics: Steven Hamington

Course Title	COMPOSITE AND NANO MATERIALS				B.Tech ME (MINOR)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
20MN310	PCC	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 Objective:

- To understand the variety of composite materials (anisotropic material) vis a vis metals and alloys from the view point of industrial applications
- To understand manufacturing methods of composites for economic production To understand methods of analysis to help effective product design.

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

CO 1	Understand Fundamentals of composites .
CO 2	Analyse Polymer matrix composites
CO 3	Differentiate Particulate Composites- Hybrid composites
CO 4	Understand Classification of ceramic materials
CO 5	Identify Various CAPP.MRP. capacity planning. Automatic identification methods, barcode technology concepts.

UNIT – I

Introduction To Composites: Fundamentals of composites - need for composites – Role of Interface in Composite Performance and Durability, classification of composite materials, Particle reinforced composites - Fiber reinforced composites- structural composites Fiber glass reinforced composites- Fabrication of Fiber reinforced composites by pultrusion, Prepreg production process Applications of various types of composites

UNIT - II

Matrix Composites: Functions of matrix phase, essential requirements of good matrix material, properties governed by matrix phase Polymer matrix composites (PMC) - Metal matrix composites (MMC) - Ceramic matrix composites (CMC) - Carbon – Carbon composites (CCC), Properties and applications.

UNIT III - III

Ceramic Composite Materials (Concretes) Characteristics, Various types of ceramic composite materials, Portland Cement Concretes (PCC), Reinforced Cement Concrete (RCC), Pre stressed

Concrete (PC), Post Tensioning in Reinforced Concrete (PTRC), Particulate Composites- Hybrid composites, Properties and applications.

UNIT - IV

Ceramic Materials: Classification of ceramic materials – properties – advantages – limitations and applications of ceramic materials. GLASSES Types of glasses – Fabrication of glass by Blowing- Flat Drawing – Rolling – Pressing in to moulds- Casting – Spinning – crystalline ceramics.

UNIT - V

Modern Materials: Introduction to nano phase materials, Characteristics, properties and applications Shape memory alloys - properties and applications Smart materials alloys- properties and applications 21 Advanced Ceramics – Cermets - properties and applications

Text Books:

1. Mathews F.L. and Rawlings R.D., Composite materials: Engineering and Science, Chapman and Hall,London, England, 1st edition, 1994.
2. Chawla K.K., Composite materials, Springer – Verlag, 1987
3. Materials Science & Engineering, Shashi Chawla.

Reference Books:

1. Clyne T.W. and Withers P.J., Introduction to Metal Matrix Composites, Cambridge University Press,1993.
2. Strong A.B., Fundamentals of Composite Manufacturing, SME, 1989.
3. Sharma S.C., Composite materials, Narosa Publications, 2000.
4. Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy, IIT- Madras, December 2001.

	MANUFACTURING TECHNOLOGY				B.Tech(MINOR)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
20MN311	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Mid Exam Duration: 1.5 Hrs						**Sem.-End Exam Duration: 3 Hrs**		

Pre-Requisites: Fundamentals of chemistry

Course Objectives:

CE1: Know the working principle of different metal casting processes and gating system.

CE2: Classify the welding processes, working of different types of welding processes and welding defects.

CE3: Know the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.

CE4: Understand the principles of forging, tools and dies, working of forging processes.

CE5: Know about the Additive manufacturing.

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

CO1: Design the patterns and core boxes for metal casting processes .

CO2: Understand the different welding processes.

CO3: Demonstrate the different types of bulk forming processes.

CO4: Understand sheet metal forming processes.

CO5: Learn about the different types of additive manufacturing processes.

UNIT-I:

Casting: Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types of cores , Principles of Gating, Risers, casting design considerations. Methods of melting and types of furnaces, Solidification of castings and casting defects- causes and remedies. Basic principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

UNIT-II:

Welding: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, submerged arc welding, TIG& MIG welding. Electro–slag welding. Resistance welding, Friction welding, Friction stir welding, Forge

welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering &Brazing. welding defects –causes and remedies

UNIT-III:

Bulk Forming: Plastic deformation in metals and alloys-recovery, recrystallization and grain growth. Hot working and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging-Types of Forging, forging defects and remedies; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

UNIT-IV:

Sheet metal forming*:* Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools.High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

UNIT-V:

Additive manufacturing Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications

Text Books:

1. Kalpakjain S and Steven R Schmid, Manufacturing Processes for Engineering Materials, 5/e, Pearson Publications, 2007.
2. P.N. Rao, Manufacturing Technology -Vol I, 5/e, McGraw Hill Education, 2018.

Reference Books:

1. A.Ghosh & A.K.Malik, Manufacturing Science, East West Press Pvt. Ltd, 2010.
2. Lindberg and Roy, Processes and materials of manufacture, 4/e, Prentice Hall India Learning Private Limited, 1990.
3. R.K. Jain, Production Technology, Khanna Publishers, 2022.
4. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
5. H.S. Shaun, Manufacturing Processes, 1/e, Pearson Publishers, 2012.
6. WAJ Chapman , Workshop Technology, 5/e, CBS Publishers & Distributors Pvt.Ltd, 2001.
7. Hindustan Machine Tools, Production Technology, Tata McGraw Hill Publishers, 2017.

Course Title	GASTURBINE AND JET PROPULSION				B.Tech (MINOR)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
20MN308	PCC	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 Objective:

- **OBJECTIVE:**
  Student gets acquitted with Principle of operation of a gas turbine. Understand the basic analytical fundamentals that are used to create and manipulate.
- Understand the possible applications of the gas turbine

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

CO 1	Understand Fundamentals, basic fluid dynamics definition
CO 2	Solve various intercooled cycle with heat exchanger inter cooled and reheat cycle problems
CO 3	Analyse Centrifugal compressors
CO 4	Understand factors affecting combustion chamber performance
CO 5	Differentiate impulse and reaction turbines

UNIT - I

Introduction: Prime Movers-Simple Gas Turbine – Review of basic principles: Definitions and laws –Energy equation- basic fluid dynamics definition-stream tube area –velocity reaction- normal shock waves- equations of motion for a normal shock wave

UNIT-II

Ideal cycles and their analysis: Assumptions in Ideal cycle analysis- simple gas turbine cycle- heat exchange cycle- reheat cycle- reheat and heat exchange cycle- intercooled cycle- intercooled cycle with heat exchangerinter cooled and reheat cycle- Simple problems.

UNIT-III

Centrifugal compressors: Essential parts of a centrifugal compressor- principle of operation- ideal energy transfer- blade shapes and velocity triangles- analysis of flow through the compressor- compressor characteristics-surging and choking-Simple problems.

UNIT-IV

Combustion systems: Combustion theory applied to gas turbine combustor- factors affecting combustion chamber design- factors affecting combustion chamber performance-requirements of combustion chamber – process of combustion in a gas turbine- combustion chamber geometry-mixing and dilution- combustion chamber arrangements.

UNIT-V

Gas turbines: Axial flow gas turbines- impulse and reaction turbines, single impulse stage, single reaction stage

Jet propulsion: Introduction- thrust, propulsive power and propulsive efficiency, classification of gas turbine engines – turbo jet engine, turbo prop engine, ram jet engine, pulse jet engine, comparison of various propulsive devices.

Text Books:

1. Gas turbines, V.Ganesan, TMH
2. Gas turbines and propulsive systems, P.Khajuria and S.P.Dubey, Dhanapath rai publications

Reference Books:

1. Gas turbine and jet rocket propulsion, V.M.Domkundwar, Dhanapath rai &Co
2. Gas turbine theory, Saravanmuttoo, H.I.H.,Rogers,G.F.C. and Cohen H., 6/e Pearson prentice Education,2008.

Course Title	Scientific Computing using MATLAB					Minor degree		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2092401	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To understand various command in MATLAB and to Solve algebraic equations using MATLAB.
- To Write the programs for curve fitting, roots of equations, Numerical Differentiation and integration.

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

CO 1	Understand various commands in MATLAB
CO 2	Solve algebraic equations using MATLAB
CO 3	Write the programs for curve fitting and roots of equations.
CO 4	Write the programs for Numerical Differentiation and integration.
CO 5	Solve optimization and Eigen value problems.

UNIT- I

Introduction to MATLAB: Introduction to MATLAB, Data Types and Variables, Arrays, Cells, Strings, Operators, Flow Control, Loops, Functions, Input/Output, Array Manipulation, Plotting.
Systems of Linear Algebraic Equations: Introduction, Gauss Elimination Method, LU Decomposition Methods, Symmetric and Banded Coefficient Matrices, Pivoting, Matrix Inversion, Iterative Methods-Gauss–Seidel Method, Conjugate Gradient Method.

UNIT -II

Interpolation and Curve Fitting: Introduction, Polynomial Interpolation-Lagrange's Method, Newton's Method, Neville's Method, Limitations of Polynomial Interpolation, Interpolation with Cubic Spline, Least-Squares Fit.
Roots of Equations: Introduction, Incremental Search Method, Method of Bisection, Brent's Method, Newton–Raphson Method, Systems of Equations, Zeros of Polynomials.

UNIT- III

Numerical Differentiation: Introduction, Finite Difference Approximations, Richardson Extrapolation, Derivatives by Interpolation.
Numerical Integration: Introduction, Newton–Cotes Formulas, Romberg Integration, Gaussian Integration, Multiple Integrals.

UNIT -IV

Initial Value Problems: Introduction, Taylor Series Method, Runge–Kutta Methods, Stability and Stiffness, Adaptive Runge–Kutta Method, Bulirsch–Stoer Method.

Two-Point Boundary Value Problems: Introduction, Shooting Method, Finite Difference Method.

UNIT -V

Symmetric Matrix Eigen value Problems: Introduction, Jacobi Method, Inverse Power and Power Methods, Householder Reduction to Tridiagonal Form, Eigen values of Symmetric Tridiagonal Matrices.

Introduction to Optimization : Introduction, Minimization Along a Line, Conjugate Gradient Methods.

Text Books:

1. JaanKiusalaas, "Numerical Methods in Engineering with MATLab", Cambridge university press, 2005.
2. Stephen J. Chapman, "MATLAB Programming for Engineers", Thomson learning, 4th edition.

Reference Books:

1. Ian Gladwell, Warren Ferguson Jr., James G. Nagy, "Introduction to Scientific Computing Using MATLAB", Lulu Publishing, 2011.
2. AlfioQuarteroni,FaustoSaleri, Paola Gervasio, "Scientific Computing with MATLAB and Octave", Springer International Publishing, 4 th edition, 2014.

NPTEL Link:

1. https://onlinecourses.nptel.ac.in/noc20_ma40/preview
2. https://nptel.ac.in/courses/111/102/111102137/

Course Title	Digital Circuits					Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2091402	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		4	-	--	4	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, Sequencedetector.

UNIT-V

Semiconductor Memories and Programmable Logic Devices: ROM- Internal structure, Static RAMandDynamicRAM.BasicPLD‟s-ROM,PROM,PLA,andPAL,RealizationofSwitching functions using basic PLD‟s. Concept of PLD‟s like CPLDs andFPGAs.

Text Books:

1. ZVI Kohavi, Switching & Finite Automata theory –, TMH, 2ndEdition.
2. Morris Mano, "Digital Design", PHI, 3rd Edition,2006.
3. 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, 2nd edition ,2006.
3. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill,1989
4. William I. Fletcher, "An Engineering Approach to Digital Design", PHI.
5. 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	Signals and systems					Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2091403	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs			

Course Objectives:

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

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

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

UNIT-I

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

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

UNIT-II

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

UNIT-III

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

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

UNIT-IV

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

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

UNIT-V

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

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

Text Books:

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

Reference Books:

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

Course Title	Probability Theory and Stochastic Processes					Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2091404	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs			

Course Objectives:

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

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

CO 1	Understand probability by modeling sample spaces.
CO 2	Apply various random processes like Gaussian, Exponential, Uniform and Poisson processes experimentally.
CO 3	Compute PSD of Random process.
CO 4	Solve complex engineering problems involving random processes

UNIT-I

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

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

UNIT –II

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

UNIT-III

Multiple Random Variables: Vector random variables, Joint distribution & Density functions , Conditional density & Distribution functions, Statistical independence, pdf and cdf for sum of

random variables, Central limit theorem, Operations on multiple random variables, Expected value of function of random variables, Joint characteristic function, Joint by Gaussian random variables, Transformations of multiple random variables.

UNIT – IV

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

UNIT-V

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

Text Books:

1. P.Z. Peebles Jr., "Probability Random Variables and Random Signal Principles", Tata McGraw- Hill, 4th Edition, 2001.
2. A. Papoulis and S. UnnikrishnaPillai, "Probability Random Variables and Stochastic Processes", 4th Edition, PHI, 2007
3. B.P. Lathi, " Modern Digital and Analog Communication Systems," Third Edition, OXFORD University press,1998.

Reference Books:

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

Course Title	Network theory					Minor Degree		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2091405	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To understand the basic concepts of magnetic circuits, resonance and network functions.
- To Solve DC and AC circuits by using various theorems.
- To Analyze RL,RC and RLC for DC and AC transient response.
- To Analyze two port networks for Z,Y,ABCD,H parameters and its relationship between them

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

CO 1	Understand the basic concepts of magnetic circuits, resonance and network functions.
CO 2	Solve DC and AC circuits by using various theorems.
CO 3	Analyze RL,RC and RLC for DC and AC transient response.
CO 4	Analyze two port networks for Z,Y,ABCD,H parameters and its relationship between them

UNIT - I

Network Theorems: Superposition theorem, Thevenin& Norton theorems, Maximum power transfer theorem, Reciprocity, Millman's and Compensation Theorems applied to DC and sinusoidal excitations.

UNIT – II

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

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

UNIT – III

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

Magnetic Circuits: Concept of self and mutual inductances, dot conventions, coefficient of coupling, series and parallel magnetic circuits, composite magnetic circuits.

UNIT – IV

Single port and multiport networks, immittance functions of two port parameters, necessary conditions for driving point and transfer functions, complex frequencies, poles and zeros, time domain response from pole zero plots, restrictions from pole zerolocations.

UNIT – V

Two port Networks: Two port networks, impedance parameters, admittance parameters, transmission parameters, hybrid and inverse hybrid parameters, relationship between parameters, conditions for symmetry and reciprocity, interconnected two port networks, terminated two port parameters and imageparameters.

Text Books:

1. Hayt and Kimmerly, "Engineering circuit analysis",7thedition
2. Van Valkenburg, "Network Analysis", 3rd edition,PHI.
3. A.Chakrabarti, "Circuit Theory", DhanapatRai& Copublications.
4. N.Sreenivasulu, "Electrical Circuits", Reempublications.

Reference Books:

1. A. Sudhakar, Shayammohan, S. Pillai, "Circuits & Networks", 4th Edition –.TMH
2. D. Roy Chowdari, "Networks and Systems", New AgeInternational
3. Stanely, "Network Analysis with applications",Pearson education 4thedition
4. G.K.Mittal, "Network Analysis by", KhannaPublishers.

Course Title	Microprocessors & Microcontrollers					Minor Degree		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2091406	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To understand various components and list out various features of microprocessor, microcontroller and peripherals.
- To Describe the internal block diagram of microprocessor, microcontroller and peripherals, addressing modes, instruction set and data transfer schemes.
- To Develop algorithm and assembly language programs to solve problems.
- To Design the microprocessor or microcontroller based system to solve real time problems.

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

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

UNIT - I

Introduction to 8085 Microprocessors: Review on Number systems, Digital logic circuits, Basic Computer Organization, Basic concepts of 8085 Microprocessor, Architecture of 8085 Microprocessor, Pin Diagram of 8085 microprocessor, Instruction Set of 8085 microprocessor, Addressing modes, Timing diagrams, Delay generation, Interrupts, Serial I/O.

UNIT - II

Introduction to 8051 Microcontrollers: Block diagram of microcontrollers, Features of 8051 microcontroller, Architecture of 8051 microcontroller, Memory organization, pin diagram of 8051 microcontroller, External memory Interfacing, Addressing modes, Instruction Set of 8051microcontroller, Delay Generation, Programming 8051 Timers/Counters, Interrupts, Serial Communication, Simple Programs.

UNIT - III

Introduction to ARM: Introduction, features, Architecture history, ARM 7 block diagram, Registers, Program Status Register, Instruction pipeline, Modes of operation, Interrupts and vector table, Instruction Set- Data Processing Instructions, Branch, Load-Store, Software interrupt, PSR instructions, Conditional instructions, Thumb instruction Set: Register Usage, Other Branch instructions, Data processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions.

UNIT - IV

The PIC microcontroller: PIC18F Introduction, Features, Memory, I/O Ports, MCU support devices, Programming model, Instructions, Instruction Description, Simple program.

The AVR microcontroller: Architecture, memory architecture, instruction architecture, Addressing modes, Timer/counter, Interrupts, Watchdog timer.

UNIT - V

Peripheral Interfacing with 8051 microcontroller: 8255 PPI and its interfacing, Interfacing Keypad, Interfacing 7-Segment LED, LCD Interfacing, ADC and DAC Interfacing.

Introduction to 8086 Microprocessor - Architecture, Instruction set, Addressing modes, Interrupt system, Pin diagram.

Text Books:

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

Reference Books:

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

NPTEL Link:

https://nptel.ac.in/courses/108/105/108105102/

Course Title	Principles of communication systems					Minor Degree		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2091407	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs			

Course Objectives:

- To Understand the fundamental concepts of Telecommunication Engineering.
- To Understand use of different modulation techniques used in Analog and Digital Communication.
- To Understand different Telecommunication systems like Satellite communication, Optical Fiber communication, Wireless communication, Mobile communication etc. and its applications.

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", 4thEdition
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	Analog and digital IC applications				Minor Degree			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2091408	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs			

Course Objectives:

- To Understand the operation and characteristics of OP-AMPs.
- To Understand multivibrator circuits and 555 timers using OP-AMPs.
- To Understand various digital logic families

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

CO 1	Understand the operation and characteristics of OP-AMPs.
CO 2	Analyze multivibrator circuits and 555 timers using OP-AMPs.
CO 3	Apply PLL in various Communication applications
CO 4	Compare various digital logic families.
CO 5	Simulate digital logic circuits using Verilog HDL.

UNIT-I

OP-AMP and its Characteristics: Integrated circuits -types, classification, package types and temperature ranges, power supplies, OP-Amp Block diagram, ideal and practical OP- Amp specifications, DC and AC characteristics, 741 OP-Amp and its features, Inverting and non-inverting amplifier.

UNIT-II

OP-AMP Applications: Integrator and differentiator, difference amplifier, instrumentation amplifier, AC amplifier, V-I, I-V converters, comparators, Multivibrators, Triangular and square wave generators, Log and antilog amplifiers, precision rectifiers.

UNIT-III

Timers and Phase Locked Loops: Introduction to 555 Timer, functional diagram, Monostable and Astable operations, Schmitt Trigger, PLL-Introduction, Block schematic, principles and description of individual blocks,565 PLL, applications.

UNIT–IV

Unipolar & Bipolar Logic Families: Introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic state electrical behavior, CMOS logic families, Bipolar logic, transistor logic, TTL families, CMOS/TTL interfacing, ECL, Comparison of logic families.

UNIT–V

Verilog Hdl and Design Examples: HDL based Design flow, Program Structure, Logic system, Nets, Variables and Constants, Vectors and Operators, Arrays, Logical Operators and Expressions.

Structural design elements, data flow design elements, behavioral design elements (procedural code). Design using basic gates, Decoders, Encoders, Multiplexers and Demultiplexers, Adders, Subtractors , SSI Latches and Flip-Flops, Counters, Design of Counters and Shift Registers .**Verilog** Modules for the above ICs.

Text Books:

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

References:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International (P) Ltd,2nd Edition, 2003.
2. James M.Fiore, "Operational Amplifiers & Linear integrated circuits &applications", Cengage2009.
3. Fundamentals of Digital Logic with Verilog Design – Stephe Brown, ZvonkoVranesic, TMH, 3rd Edition, 2014

Course Title	Industrial Electronics					Minor Degree		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2091409	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To Understand the basics of Power Electronics
- To learn the details of power semiconductor switches (Construction, Characteristics and operation).
- To understand the working of various types of converters.
- To learn how to analyze the converters and design the components of them, under various load types.

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

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

Inductors: 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," PowerElectronics".
2. Ned Mohan, Tore M. Undeland, and William P. Robbins,"Power Electronics: Converters, Applications And Design, Media Enhanced (WithCD)".
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", KhannaPublishers,1987.
2. George M. Chute,R. D. Chute, "Electronics in Industry", McGraw-Hill School Pub Co, 5th Edition,

Course Title	Digital Signal Processing.				Minor Degree			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2091410	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs			

Course Objectives:

- To Understand the properties and algorithms of DFT.
- To learn the Realization of Various Digital Filters.
- To Analyze IIR and FIR filters.
- To Design IIR filters, FIR filters Decimator and Interpolator.

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

CO 1	Understand properties and algorithms of DFT.
CO 2	Realize Various Digital Filters.
CO 3	Analyze IIR and FIR filters.
CO 4	Design IIR filters, FIR filters Decimator and Interpolator.

UNIT-I

Discrete Fourier series: DFS representation of periodic sequences, Properties of discrete Fourier series, Discrete Fourier Transform (DFT), properties of DFT, linear convolution of sequences using DFT.

Fast Fourier Transforms: Efficient computation of the DFT, Decimation in time and decimation in frequency FFT algorithms, FFT algorithms for composite N.

UNIT-II

Realization of Digital Filters: Block diagram representation of linear constant-coefficient difference equations, basic structures of IIR filters- direct form I, direct form II, transposed form, cascade form, parallel forms, basic structures of FIR filters-Direct form, Cascade form, Linear phase structure, Lattice structures.

UNIT-III

IIR Digital Filters: General considerations-Causality and its implications, Characteristics of Practical Frequency-selective filters, Design of analog filters-Butterworth and chebyshev approximations, IIR filter design by backward difference, Impulse Invariance, Bilinear transformation, design examples: frequency transformations, Illustrative Problems.

UNIT-IV

FIR Digital Filters: Symmetric and Anti-symmetric FIR filters, Design of Linear Phase FIR digital filters using windows, Frequency sampling technique, comparison of IIR and FIR filters,
Illustrative Problems, applications of DSP (Dual Tone Multifrequency signal detection, Spectral analysis of sinusoidal and nonstationary signals).

UNIT-V

Multirate Signal Processing: Introduction, Decimation, and interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of bandpass signals, Sampling rate conversion by arbitrary factor, Applications of multirate signal processing.

Text Books:

1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd ed., Pearson Education,2012.
2. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and Aapplications", Pearson Education/PHI, 4th Edition,2007.
3. Sanjit K Mitra, "Digital signal processing", A computer base approach- Tata McGraw- Hill, 3rd Edition,2009.

Reference Books:

1. Andreas Antoniou, Digital signal processing: Tata McGraw-Hill,2006.
2. M H Hayes, "Digital signal processing", Schaum's Outlines, Tata McGraw-Hill,2007.
3. A. Anand Kumar, "Digital Signal Processing," PHI Learning,2011

Course Title	Embedded System Design				Minor Degree			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2091411	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To Understand features of Embedded system.
- To the architecture of MSP 430.
- To Write MSP 430 programs for interfacing.
- To Describe the timers, interrupts and serial communication in MSP 430

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

CO 1	Understand features of Embedded system.
CO 2	Understand the architecture of MSP 430.
CO 3	Write MSP 430 programs for interfacing.
CO 4	Describe the timers, interrupts and serial communication in MSP 430

UNIT - I

Introduction To Embedded Systems: Introduction to Embedded Systems and Computer Systems Terminology, Modular approach to Embedded System Design using Six-Box model, Input devices, output devices, embedded computer, communication block, host and storage elements and power supply. Microcontroller Based Embedded System Design. Salient Features of Modern Microcontrollers. Elements of Microcontroller Ecosystem and their significance.Design of Power Supply for Embedded Systems.Linear Regulator Topologies.Switching Power Supply Topologies. Power Supply Design Considerations for Embedded Systems.

UNIT - II

Introduction to MSP430 Microcontroller: MSP430 CPU Architecture, Programming Methods for MSP430, Introduction to Lunchbox Platform, Fundamentals of Physical Interfacing, Connecting Input Devices:Switches, Keyboard and Output devices: LEDs, Seven Segment Displays(SSD), Advanced Physical Interfacing: Driving load - high side, low side and H-bridge, Multiplexing displays including Charlieplexing, Shaft encoder.

UNIT - III

Programming the MSP430: Basics of version control system - Git, Installing and using Code Composer Studio(CCS), Introduction to Embedded C.

Interfacing: Interfacing LEDs and Switches with MSP430 using Digital Input and Output, Interfacing Seven Segment Displays and Liquid Crystal Displays with MSP430, ADC operation in MSP430, Interfacing analog inputs, Generating random numbers using LFSR and other methods, Adding DAC to MSP430, Custom Waveform generation using MSP430.

.**UNIT - IV**

MSP430 Microcontroller-Interrupts and Timers: MSP430 Clock and Reset System, MSP430 Clock sources and distribution, Types of Reset sources, Handling Interrupts in MSP430, Writing efficient Interrupt Service Routine(ISR).

Low Power Modes in MSP430, Introduction to MSP430 Timer Module and it's Modes of Operation. Generating Pulse Width Modulation (PWM) using Timer Capture Mode, Timer Capture Modes, Measuring frequency and time period of external signals and events,

UNIT - V

MSP430 Microcontroller- Serial Communication: Serial Communication Protocols: UART, SPI, I2C, Interfacing Universal Serial Communication Interface (USCI) Module of the MSP430 for UART Communication, Advanced Coding Exercises based on Interrupt driven Programming. Building an Electronics Project. Circuit Prototyping techniques, Designing Single Purpose Computers using Finite State Machine with Data path (FSMD) approach, MSP430 Based Project Design and Implementation.

Text Books:

1. John Catsoulis, " Designing Embedded Hardware", Shroff Publishers and Distributors, 2nd edition.
2. Tony Givargis and Frank Vahid, " Embedded System Design: A Unified Hardware /Software Introduction" ,Wiley, ISBN-10:812650837X.

Reference Books:

1. John H. Davies. Elsevier, "MSP430 Microcontroller Basics", ISBN-10:9789380501857.
2. Micheal Barr, " Programming Embedded Systems in C and C++" Shroff Publishers and Distributors, ISBN-10: 817366076X

NPTEL Links:

1. https://onlinecourses.nptel.ac.in/noc20_ee98/preview
2. https://nptel.ac.in/courses/108/102/108102169/

Course Title	Electronic Instrumentation and Measurements				Minor Degree			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2091412	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To understand the performance characteristics of an instruments.
- To the principle of analog, digital voltmeters and wave analyzers
- To Use AC and DC bridges for relevant parameter measurement.
- To Apply the complete knowledge of various electronic transducers to measure the physical Quantities in the field of science and technology

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

CO 1	**Understand** the performance characteristics of an instruments.
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 Books:

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.

Course Title	VLSI Design				Minor Degree			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2091413	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To Understand the design rules and scaling concepts
- To Understand the various IC technologies and fabrication steps
- To Analyze the basic electrical properties of MOS and BICMOS logic circuits

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

CO 1	Understand the design rules and scaling concepts
CO 2	Understand the various IC technologies and fabrication steps
CO 3	Apply the basic functional modules for sub system design
CO 4	Analyze the basic electrical properties of MOS and BICMOS logic circuits
CO 5	Understand the models of integrated circuit design and testing techniques

UNIT-I

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & Bi-CMOS technologies-Substrate preparation, Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Probe testing, Integrated Resistors and Capacitors.

UNIT-II

Basic Electrical Properties: Basic Electrical Properties of MOS and Bi-CMOS Circuits: $I_{ds}VsV_{ds}$ relationships, MOS transistor threshold Voltage, g_m, g_{ds}, Figure of merit, Pass transistor, NMOS Inverter, Various pull ups and Pull downs, CMOS Inverter analysis and design, 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, Contacts and transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT-IV

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Basic circuit concepts, Sheet Resistance(R_S) concept and Sheet Resistance R_S in MOS, Area Capacitance Units, Calculations Delays, Driving large Capacitive Loads, Wiring Capacitances.

Subsystem Design: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters, High Density Memory Elements.

UNIT-V

Semiconductor Integrated Circuit Design: PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic(PLA'S), Design Approach.

CMOS Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques, Layout Design for improved Testability.

Text Books:

1. Kamran Eshraghian, EshraghianDougles and A. Pucknell, Essentials of VLSI circuits andsystems, 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. John M. Rabaey, Digital Integrated Circuits, PHI, EEE, 1997.
3. Wayne Wolf, Pearson Education, Modern VLSI Design, 3rd Edition,1997.
4. S.M. SZE, VLSI Technology, 2nd Edition, TMH,2003.

Course Title	Digital Image Processing					Minor Degree		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2091414	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**			

Course Objectives:

- To Understand various image processing parameters
- To Understand image filtering, segmentation and compression
- To Compare different 2D transforms Color models and image restoration techniques

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

CO 1	Understand various image processing parameters
CO 2	Explain image filtering, segmentation and compression
CO 3	Compare different 2D transforms Color models and image restoration techniques
CO 4	Apply the concepts of image processing techniques in various applications.
CO 5	Analyze mathematical operations, coding and filtering methods in image processing.

UNIT-I

Introduction: Fields that use digital image processing, fundamental Steps in Digital Image Processing, Components of an Image processing system, elements of Visual Perception. Image sensing and Acquisition, Image formation model, Image Sampling and Quantization - Representing digital images, spatial and intensity resolution. Relationship between pixels - neighbours of a pixel, Adjacency, Connectivity, Regions and boundaries, distance measures, Mathematical tools in digital image processing – Array versus matrix operations, Linear and Nonlinear Operations, Arithmetic operations, geometrical spatial transformations and image registration.

UNIT-II

Image Transforms: General approach for operating in the linear transform domain, 2-D DFT and Properties, Walsh transform, Hadamard Transform, Discrete cosineTransform, Haar transform, Slant transform, KL Transform or Hotelling transform

UNIT-III

Image Enhancement: Image enhancement in Spatial domain - Some Basic Intensity Transformations, Histogram Processing, Enhancement, Basics of Spatial filtering, Smoothing spatial filtering, sharpening spatial filters, Combining spatial enhancement methods.

Image enhancement in the Frequency Domain –Basics of filtering in frequency domain, Image smoothing and sharpening in frequency domain, homomorphic filters. Color image processing, Color fundamentals, colormodels.

UNIT-IV

Image Restoration: Degradation model, Noise models, Restoration in the presence of noise only–spatial filtering, Periodic noise reduction by frequency domain filtering, Linear position- Invariant degradation, Inverse filtering, least mean square (Wiener) filters, Constrained Least Squares filtering.

Image Segmentation: Point, Line and Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation – Region growing, Region splitting and merging.

UNIT-V

Image Compression: Redundancies in images, Fidelity criteria, Image compression models, Error free compression – Variable length coding, Huffman coding, Arithmetic coding, LZW coding, Bit-plane coding, loss less and lossy predictive coding, Transform coding, Image Compression standards.

Text Books:

1. R.C. Gonzalez & R.E. Woods, "Digital Image processing", Addison Wesley/Pearson Ed., 2nd Edition, 2002.
2. A.K.Jain, "Fundamentals of Digital Image processing", Prentice Hall of India.

Reference Books:

1. Rafael C. Gonzalez, Richard E Woods and Steven L, "Digital Image processing using MAT LAB", Edition, PEA, 2004.
2. William K. Pratt, "Digital Image Processing", John Wiley, 3rd Edition,2004.
3. Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing, TataMcGraw Hill Education,2011.

Course Title	Biomedical Instrumentation				Minor Degree			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2091415	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		4	-	--	4	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs			

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 agencies publications.

Course Title	COMPUTER NETWORKS				B.Tech CSE- V Sem (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091501	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- Study the evolution of computer networks and future direction.
- Study the concepts of computer networks from layered.
- Perspective study the issues open for research in computer networks.

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

CO 1	Understand the terminology and concepts of the OSI reference model and TCP-IP.
CO 2	Describe the functions of Data link layer and its protocols.
CO 3	Classifying the different routing algorithms and IP addressing with network layer
CO 4	Understand connection establishment and services provides by TCP and UDP.
CO 5	Explain the working of DNS and World Wide Web.

UNIT – I

Introduction: Uses of Computer Networks, Network Hardware, Reference Models: OSI, TCP/IP, Comparison of OSI & TCP/IP reference models.

Introduction to physical layer: Data and Signals, Transmission impairment, Datarate limits, Performance.

Transmission media: Introduction, Guided Media, Unguided Media.

Switching: Introduction, Circuit Switched Networks, Packet Switching.

UNIT – II

The Data Link Layer: Data Link Layer design issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols.

The Medium Access Control sublayer : Multiple Access protocols, Ethernet, Data Link Layer Switching.

UNIT – III

The Network Layer: Network layer design issues, Routing algorithms : The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, Congestion control algorithms, Quality of service, IP Addresses, IPv4,IPv6,Tunneling, Fragmentation.

UNIT - IV

The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control,The internet transport protocols: UDP, TCP: Introduction to TCP, Service Model, Protocol, Segment Header, Connection Establishment, Connection Release.

UNIT – V

The Application layer: Domain Name System (DNS), World Wide Web (WWW), E-mail.

Text Books:

1. "Computer Networks", Andrew S. Tanenbaum, David J.Wetherall, Pearson, 5th edition, 2010.
2. "Data communications and networking", Behrouz A. Forouzan, TMH, 5th edition, 2012.
3. "Internetworking with TCP/IP – Principles, protocols, and architecture- Volume 1,Douglas E. Comer, 5th edition, PHI
4. "Computer Networks", 5E, Peterson, Davie, Elsevier.

Reference Books:

1. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRC Publications.
2. "Computer Networks and Internets with Internet Applications", Comer.
3. "Computer Networks, A Top-Down Approach", James F. Kurose, Keith W. Ross, 3rd Edition, Pearson.
4. Computer Networks, A Top-Down Approach, Behrouz A. Forouzan, Firoz Mosharraf, Special Indian Edition, McGraw Hill.

Course Title	COMPUTER ORGANIZATION				B.Tech CSE- V Sem (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091502	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- To make the students understand the structure of computers and internalorganization of different units like memory, I/O devices, registers.
- To study in detail about the microoperationsand implementation of fixed andfloating point addition, subtraction, multiplication and division operations.
- To study in detail about pipelining, Memory, I/O organization and multiprocessors.

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

CO 1	Understand the Basic concepts of computers and Data representation.
CO 2	Understand the concept of Register Transfer and various Micro operations.
CO 3	Understand the concept of basic computer organization and design, Micro programmed control and Computer Arithmetic.
CO 4	Understand the concept of Pipelining and Memory.
CO 5	Understand concept of I/O organization and Multiprocessors.

UNIT-I

Basic Concepts of Computers: Computer Types, Functional units, Basic operational concepts, Bus Structures, Performance. **Data Representation-** Fixed Point Representation, Floating Point Representation.

UNIT-II

Register Transfer and Microoperations: Register Transfer, Bus and memory transfers. Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

UNIT-III

Basic Computer Organization and Design: Instruction codes, Computer instructions, Memory Reference Instructions, Input – Output and Interrupt, Addressing modes. **Micro Programmed Control:** Control memory, Address sequencing, Micro program example, Design of control unit, Hard wired control, Micro programmed control. **Computer Arithmetic:** Addition and subtraction, multiplication Algorithms, Division Algorithms.

UNIT-IV

Pipeline: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline.

Memory: Basic concepts, Memory Hierarchy, Cache memory, Performance considerations, Virtual memory.

UNIT-V

Input-Output Organization: Peripheral Devices, Input- Output Interface, Asynchronousdata transfer, Modes of Transfer, Priority Interrupt, Direct memory Access (DMA).

Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures.

Text Books:

1. Computer Organization – Carl Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill.
2. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI.
3. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

Reference Books:

1. Fundamentals of Computer Organization and Design, - SivaraamaDandamudi, Springer Int. Edition.
2. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition, Elsevier.
3. Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, BS Publication.

Course Title	MOBILE APPLICATION DEVELOPMENT				B.Tech CSE-VI Sem (Minor Degree)		
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
2091503	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Min				**End Exam Duration: 3Hrs**			

Course Objectives:

- To Understand fundamentals of android operating systems.
- To learn the internals of the Android OS
- To learn the Mobile application development using the Android SDK.

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

CO 1	Understand the key features of various Mobile Operating Systems.
CO 2	Know essential Android programming concepts
CO 3	Develop Android Applications using GUI components
CO 4	Demonstrate and implement Database connectivity Applications

UNIT I

Android Introduction and Basics: The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge (ADB), Launching Android Applications on a Handset.

UNIT II

Basic Widgets: Understanding the Role of Android Application Components, Understanding the Utility of Android API, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.

UNIT III

Building Blocks for Android Application Design: Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation.

Utilizing Resources and Media: Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application,

Scrolling Through Scroll View, playing Audio, Playing Video, Displaying Progress with Progress Bar, Using Assets.

UNIT IV

Using Selection widgets and Debugging: Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control, Using the Debugging Tool: Dalvik Debug Monitor Service(DDMS), Debugging Application, Using the Debug Perspective.

Displaying And Fetching Information Using Dialogs and Fragments: What Are Dialogs?, Selecting the Date and Time in One Application, Fragments, Creating Fragments with java Code, Creating Special Fragments.

UNIT V

Building Menus and Storing Data: Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar.

Using Databases: Using the SQLiteOpenHelperclasss, Accessing Databases with the ADB, Creating a Data Entry Form.

Text Books:

1. Android Programming by B.M Harwani, Pearson Education, 2013.
2. Android application Development for Java Programmers, James C Sheusi, Cengage Learning
3. Android In Action by w.Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz., Dreamtech.
4. Beginning Android 4 Application Development, by Wei-Meng Lee , Wiley India.

Reference Text Books:

1. Android Programming for Begineers, John Horton, Packt> Publications.
2. Professional Android 4 Application Development, Reto Meier, Wiley.
3. Android Programming: Big Nerd Ranch Guide, Bill Phillips, Chris Stewart, Pearson

Course Title	ARTIFICIAL INTELLIGENCE				B.Tech CSE-VI Sem (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
2091504	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- To understand how a computer making intelligent decisions.
- To understand the notions of state space representation, heuristic search methods.
- To learn different knowledge representation techniques
- To understand the applications of AI.

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

CO 1	Given a search problem, analyze and formalize the problem (as a state space, graph, etc.).
CO 2	The ability defines admissible and consistent heuristics and completeness and optimality.
CO 3	Analyze and Apply knowledge representation technique.
CO4	Ability to understand uncertainty and Design appropriate Bayes Nets corresponding to the causal relationships and conditional independence of a real world situation
CO5	Design good evaluation functions and strategies for game playing and Understand concept of natural language processing.

UNIT-I:

Introduction to AI: AI Problems History what is an AI Technique. Problem, Problem Space and Search, Heuristic Search Techniques.

UNIT-II:

Knowledge Representation Issues, Predicate Logic, Knowledge Representation using rules.

UNIT –III:

Symbolic reasoning under Uncertainty, Bayesian Networks.

UNIT-IV:

Weak Slot Filler Structures, Strong Slot and Filler Structures, Knowledge Representation summary.

UNIT –V:

Game Playing, Planning, Natural Language processing.

Text Books:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004.
3. Philip C Jackson, Introduction to Artificial Intelligence: Second, Enlarged Edition.
4. Saroj Kaushik. Artificial Intelligence. Cengage Learning, 2011.

Reference Books:

1. Charu C. Aggarwal,Artificial Intelligence,Springer,2021.
2. Adelyn Zhou, Mariya Yao and Marlene Jia Applied Artificial Intelligence: A Handbook for Business Leaders, 2017
3. Peter Norvig, Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp.
4. Dr. Dheeraj Mehrotra,Basics of Artificial Intelligence & Machine Learning
5. Chandra S.S.V,Artificial Intelligence and Machine Learning
6. Denis Rothman, Artificial Intelligence by Example

Course Title	CRYPTOGRAPHY & NETWORK SECURITY		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	**Hours/Week**	**Credits**	**Maximum Marks**		
2091505	**MOOC**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	40	60	100
Mid Exam Duration: 90 Min		**End Exam Duration: 3Hrs**			

Course Objectives:

- Extensive, thorough and significant understanding of the concepts, issues, principles and theories of computer network security
- Identifying the suitable points for applying security features for network traffic
- Understanding the various cryptographic algorithms and implementation of the same.
- Understanding the various attacks, security mechanisms and services.

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

CO 1	Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
CO 2	Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.
CO 3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
CO 4	Apply different digital signature algorithms to achieve authentication and create secure applications.
CO 5	Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
CO 6	Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications

UNIT I

Computer Security concepts, The OSI Security Architecture, Security attacks, Security services and Security mechanisms, A model for Network Security, Classical encryption techniques-symmetric cipher model, substitution ciphers, transposition ciphers, Steganography, Modern Stream ciphers.

UNIT II

Modern Block Ciphers: Block ciphers principles, Data encryption standard (DES), Strength of DES, Block cipher modes of operations, AES, RC4.

Introduction to Number theory : Integer Arithmetic, Modular Arithmetic,Linear Congruence, Algebraic Structures, GF(2n) Fields, Primes, Factorization, Chinese remainder Theorem, Quadratic Congruence.

UNIT III

Public-key cryptography : Principles of public-key cryptography, RSA Algorithm, Diffie-Hellman Key Exchange, ELGamal cryptographic system.

Cryptographic Hash functions: Applications of Cryptographic Hash functions, Requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA).

UNIT IV

Message Authentication Codes: Message authentication Requirements, Message authentication functions, Message authentication codes, security of MACs, HMAC.

Digital Signatures: Digital Signatures, Schnorr Digital Signature Scheme, Digital Signature Standard.

UNIT V

User Authentication: Remote user Authentication Principles, Kerberos

Electronic mail security: Pretty Good Privacy (PGP), S/MIME

Worms, Viruses, Firewalls.

Text Books:

1. Cryptography and network Security by Fourth edition, Stallings, PHI/Pearson
2. Cryptography & Network Security by Behrouz A. Forouzan, TMH.
3. Network Security: The complete reference by Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY.

Reference Books:

1. Cryptography and network Security by Atul Kahate, 4th Edition, Tata McGraw Hill.
2. Understanding Cryptography, Christof Paar. Jan Pelzl, Springer.
3. Introduction to Modern Cryptography, Jonathan Katz, Yehuda Lindell, 2nd Edition, CRC Press.

Course Title	BIG DATA TECHNOLOGIES		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	**Hours/Week**	**Credits**	**Maximum Marks**		
2091506	**MOOC**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	40	60	100
Mid Exam Duration: 90 Min		**End Exam Duration: 3Hrs**			

Course Objectives:

- To introduce big data concepts.
- Understanding Hadoob.
- Understanding Big data Applications (HBASE, HIVE).

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

CO 1	Demonstrate knowledge in Big Data Characteristics & Hadoop Distributed File System.
CO 2	Analyze large data sets by using Hadoop, Map Reduce, Hive.
CO 3	Design and develop Map Reduce models for data sets.
CO 4	Select Hive and Hive services techniques for effective database models.
CO 5	Contribute towards societal issues and responsibilities in designing, modeling and developing Big Data systems

UNIT – I

Introduction to Big Data, Why is Big Data, Why Big Data is important, Meet Hadoop, Data, Data Storage and Analysis, Comparison with other systems, Grid Computing, A brief history of Hadoop, Apache Hadoop and the Hadoop EchoSystem, Linux refresher; VMWare Installation of Hadoop.

UNIT – II

The Design of HDFS, HDFS Concepts, Command Line interface to HDFS Hadoop File Systems, Interfaces, Java Interface to Hadoop, Anatomy of a file read, Anatomy of a file write, Replica placement and Coherency Model, Parallel copying with distcp, Keeping an HDFS cluster balanced.

UNIT – III

Introduction, Analyzing data with unix tools, Analyzing data with Hadoop, Java MapReduce classes(new API), Data flow, combiner functions, Running a distributed MapReduce job, Configuration API, Setting up the developing environment, Managing configuration, Writing a unit test with MRUnit, Running a job in local job runner, Running on a cluster, Launching a job, The MapReduce WebUI.

UNIT - IV

Class MapReduce, Job submission, Job initialization, Task Assignment, Task execution, Progress and status updates, Job Completion, Shuffle and sort on Map and Reducer side, Configuration tuning, Map Reduce types, Input formats, Sorting, Map side and Reduce side joins.

UNIT - V

The Hive Shell, Hive services, Hive clients, The meta store, comparison with traditional databases, Hive QI, Hbasics, Concepts, implementation, Java and Map reduce clients, Loading Data, Web queries.

Text Books:

1. Tom White, Hadoop, "The Definitive Guide" , 3rd Edition, O'Reilly Publications,2012.
2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Undetstanding Big Data Analytics for Enterprise class Hadoop and Streaming Data", 1st Edition, TMH, 2012.
3. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Publications, 2014.
4. Big Data Technologies and Applications, Borko Furht, Flavio Villanustre, Springer.

Reference Books:

1. Hand Book of Big Data Technologies, Albert Y. Zomaya, Sherif Sakr, Springer.
2. Big Data Analytics: Tools and Technology for Effective Planning, Arun K. Somani, Ganesh Chandra Deka, CRC Press.
3. Big Data, Big Analytics, Michael Minelli, Michele Chambers, Ambiga Dhiraj, John Wiley and Sons.

Course Title	INTERNET OF THINGS		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	**Hours/Week**	**Credits**	**Maximum Marks**		
2091507	**MOOC**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	40	60	100
Mid Exam Duration: 90 Minutes		**End Exam Duration: 3Hrs**			

Course Objectives:

- Basic principles of IOT.
- Various IOT platforms and application development.
- To know about Arduino board.
- To know about Raspberry pi.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Demonstrate knowledge on Protocols, functional blocks and communication models of Internet of Things.
CO 2	Identify domain specific IoT's.
CO 3	Design appropriate solutions for IoT applications.
CO4	Working with Arduino board.
CO5	Design and develop applications using Raspberry pi device.

UNIT - I

Introduction to IoT: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Development Templates.

UNIT - II

Domain Specific IoTs: Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.

UNIT - III

IOT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT
IoT Platform Design Methodology: Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring.

UNIT - IV

Introduction to Arduino: Introduction, The Arduino Way, The Arduino Platform, Getting started with Arudino, Advanced Input and Output, Sample Programs.

Sensors: Introduction to sensors, Transducer, Sensors characteristics.

UNIT - V

IOT Physical Devices: What is an IOT device, basic building blocks of an IOT device, Exemplary device: Raspberry Pi, about the board, linux on raspberry Pi, raspberry Pi interfaces, Programming Raspberry Pi with Python, Other IoT Devices.

Text Books:

1. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India.
2. Getting Started with Arduino, 3rd Edition, Massimo Banzi and Michael Shiloh
3. Getting Started with Raspberry Pie, Matt Richardson & Shawn Wallace, O'Reilly-2014.
4. ArshdeepBahga, Vijay Madisetti " Internet of Things(A hands on approach)" 1STedition, VPI publications,2014.

Reference Books:

1. Raj Kamal, "Internet of Things", McGraw Hill, 1st Edition, 2016.
2. Internet of Things, Surya Durbha, Jyothi Joglekar, Oxford Higher Education.
3. The Internet of Things, Michael Miller, Pearson.
4. The Internet of Things, Samuel Greengard, The MIT Press Ltd

Course Title	SOFTWARE ENGINEERING		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	**Hours/Week**	**Credits**	**Maximum Marks**		
2091508	**MOOC**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	40	60	100
Mid Exam Duration: 90 Minutes		**End Exam Duration: 3Hrs**			

Course Objectives:

- Knowledge of basic Software engineering methods and practices, and their appropriate application also the software engineering layered technology and Process frame work.
- A general understanding of software process models such as the waterfall and evolutionary models.
- Understanding of the role of project management including planning, scheduling, risk management, etc.
- Understanding of data models, object models, context models and behavioural models also different software architectural styles.
- Understanding of software testing approaches such as unit testing and integration testing other testing strategies and Risk management.

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

CO 1	Ability to apply software engineering principles and techniques.
CO 2	Ability to develop, maintain and evaluate large-scale software systems.
CO 3	To produce efficient, reliable, robust and cost-effective software solutions.
CO 4	To manage time, processes and resources effectively by prioritising competing demands to achieve personal and team goals Identify and analyzes the common threats in each domain.

UNIT – I

Software and Software Engineering: The Nature of Software, Software Engineering, Software Process Software Myths. Process Models: A Generic Process Model, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models.

UNIT – II

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, ElicitingRequirements, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

Requirements Modeling: Requirements Analysis, Scenario-Based Modeling, Data Modeling Concepts, Class-Based Modeling.

UNIT – III

Design Concepts: Design within the Context of Software Engineering, Design Process, Design Concepts, The Design Model.

Architectural Design: Software Architecture, Architectural Genres, Architectural Styles, ArchitecturalDesign.

UNIT – IV

User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Coding and Testing: Testing, Testing in the Large versus Testing in the Small, Unit Testing, Integration Testing, Black-Box Testing, White-Box Testing, Debugging, System Testing.

UNIT – V

Software Project Management: Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO-A Heuristic Estimation Technique, Halstead's Software Science-An Analytical Technique, Risk Management.

Text Books:

1. Software Engineering: A practitioner's Approach, Roger S. Pressman, Seventh Edition, 2010,McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, 4th Edition, 2014, PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearson education.
4. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008.

Reference Books:

1. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
3. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
4. Software Engineering2: Specification of systems and languages, Diner Bjorner, Springer International edition , 2006.
5. Software Engineering Foundations, Yingxu Wang, Auerbach Publications,2008.

<table>
<tr><td colspan="2">Course Title</td><td colspan="2">DESIGN AND ANALYSIS OF ALGORITHMS</td><td colspan="3">B.Tech CSE-VII Sem (Minor Degree)</td></tr>
<tr><td colspan="2">Course Code</td><td colspan="2">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">2091509</td><td colspan="2" rowspan="2">MOOC</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>2</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="4">Mid Exam Duration: 90 Minutes</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives:
• To understand and apply the algorithm analysis techniques.
• To critically analyze the efficiency of alternative algorithmic solutions for the same problem.
• To understand different algorithm design techniques.
• To understand the limitations of Algorithmic power.</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="7">Prove the correctness and analyze space and time complexity of an algorithm.</td></tr>
<tr><td>CO 2</td><td colspan="7">Understand different algorithm design strategies.</td></tr>
<tr><td>CO 3</td><td colspan="7">Analyze & Apply standard algorithms.</td></tr>
<tr><td>CO 4</td><td colspan="7">Understand Graph/Tree bases applications and appropriate techniques.</td></tr>
<tr><td>CO 5</td><td colspan="7">Current trends in Non Deterministic concepts.</td></tr>
</table>

UNIT-I

Introduction: What is an algorithm? Algorithm Specification, **Performance Analysis**: Space complexity, Time Complexity**. Asymptotic Notations**: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), **Brute Force Method:** Sequential Search, Selection Sort, Bubble Sort.

UNIT-II

Divide and Conquer: General method, Binary search, Merge sort, Quick sort, Strassen's Matrix multiplication.

Greedy Method: General method, Knapsack Problem, Job sequencing with deadlines. **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm.

UNIT-III

Dynamic Programming: General method, Multistage Graphs, All Pairs Shortest Paths, Single Source Shortest Path, Optimal Binary Search Trees,0/1Knapsack problem, Travelling Sales Person problem .

UNIT-IV

Search and Traversal techniques: Techniques for Binary tree, Technique for Graphs, connected components and spanning tree, Bi connected components.

Backtracking: General method, N-Queens problem, Sum of sub sets problem, Graph coloring, Hamiltonian cycles.

UNIT-V

Branch and Bound: Travelling Sales Person problem, 0/1Knapsack problem: LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Complete and NP-Hard problems: Basic concepts on-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran,"Fundamentals of Computer Algorithms", Galgotia Publications.
2. Levitin, Anany." Introduction to the design & analysis of algorithms**"** Pearson Education, 2008.
3. Udit Agarwal," Algorithms Design and Analysis",Dhanpath Rai & Co,2017.
4. Sedgewick Robert and Kevin Wayne, "Algorithms" , Pearson Education, Fourth Edition.
5. Parag H.Dave Himanshu B.Dave "Design and Analysis of Algorithms" Pearson Education 2008.

Reference Books:

1. Aho, Hopcroft, Ulman,"the Design and Analysis of Computer Algorithms" Pearson Education, 2000.
2. Steven S.Skiena," The Algorithm Design Mannual", Spingers, Third Edition.
3. R.L.Rivest and C.Stein" Introduction to Algorithms",Second Edition, Pearson Education
4. M.T.Goodrich and R.Tomassia, John Wiley and sons," Algorithm Design: Foundations, Analysis and Internet examples".
5. Sanjoy Dasgupta, Christos H Papadimitriou, Umesh Virkumar Vazirani, "Algorithms" , McGraw-Hill Higher Education,2008

Course Title	NATURAL LANGUAGE PROCESSING		B.Tech CSE-VII Sem (Minor Degree)		
Course Code	**Hours/Week**	**Credits**	**Maximum Marks**		
2091510	**MOOC**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	40	60	100
Mid Exam Duration: 90 Min		**End Exam Duration: 3Hrs**			

Course Objectives:

- Understand approaches to syntax and semantics in NLP.
- Understand current methods for statistical approaches to machine translation.
- Understand language modeling.
- Understand machine learning techniques used in NLP.

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

CO 1	Understand the fundamentals required for Computational Linguistics
CO 2	Understand the concepts of Language design, Text Transformer and their Products
CO 3	Have the clear idea of language specifications using context and free grammars
CO 4	Understand machine learning techniques used in NLP

UNIT I

Introduction to Natural Language Understanding, Syntactic Processing: Grammars and Parsing.

UNIT II

Features and Augmented Grammars, Toward Efficient Parsing, Ambiguity Resolution.

UNIT III

Statistical Methods: Probabilistic Context-Free Grammars, Best-First Parsing.

UNIT IV

Semantic Interpretation: Linking Syntax and Semantics, Ambiguity Resolution, other Strategies for Semantic Interpretation.

UNIT V

Context and World Knowledge: Using World Knowledge, Discourse Structure, Defining a Conversational Agent.

Text Book:

1. Natural Language Understanding – James Allen, Second Edition, Pearson Education.
2. Speech and Language Processing – Daniel Jurafsky, James H.Martin.
3. Foundations of Statistical Natural Language Processing – Christopher Manning, Hinrich Schutze, MIT Press.
4. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.

Reference Books:

1. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2013-2014
2. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
3. Introduction to Natural Language Processing,Jacob Eisenstein, MIT Press.
4. Natural Language Processing In Action, Hobson Lane, Cole Howard & Hannes Max Hapke, Manning Publications.

Course Title	COMPUTER NETWORKS				B.Tech. AI&ML V Sem (Minor Degree)		
Course Code	Hours / Week			Credits	Maximum Marks		
20913901	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- Study the evolution of computer networks and future direction.
- Study the concepts of computer networks from layered.
- Perspective study the issues open for research in computer networks.

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

CO1	Understand the terminology and concepts of the OSI reference model and TCP-IP.
CO2	Describe the functions of Data link layer and its protocols.
CO3	Classifying the different routing algorithms and IP addressing with network layer
CO4	Understand connection establishment and services provides by TCP and UDP.
CO5	Explain the working of DNS and World Wide Web.

UNIT - I

Introduction: Uses of Computer Networks, Network Hardware, Reference Models: OSI, TCP/IP,Comparison of OSI & TCP/IP reference models.

Introduction to physical layer: Data and Signals, Transmission impairment, Datarate limits, Performance.

Transmission media: Introduction, Guided Media, Unguided Media.

Switching: Introduction, Circuit Switched Networks, Packet Switching.

UNIT - II

The Data Link Layer: Data Link Layer design issues, Error Detection and Correction, ElementaryData Link Protocols, Sliding Window Protocols.

The Medium Access Control sublayer: Multiple Access protocols, Ethernet, Data Link LayerSwitching.

UNIT - III

The Network Layer: Network layer design issues, Routing algorithms: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, Congestion control algorithms, Quality of service, IP Addresses, IPv4, IPv6, Tunneling, Fragmentation.

UNIT - IV

The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control, the internet transport protocols: UDP, TCP: Introduction to TCP, Service Model, Protocol, Segment Header, Connection Establishment, Connection Release.

UNIT - V

The Application layer: Domain Name System (DNS), World Wide Web (WWW), E-mail.

Text Books:

1. "Computer Networks", Andrew S. Tanenbaum, David J.Wetherall, Pearson, 5th edition, 2010.
2. "Data communications and networking", Behrouz A. Forouzan, TMH, 5th edition, 2012.
3. "Internetworking with TCP/IP – Principles, protocols, and architecture- Volume 1,Douglas E. Comer, 5th edition, PHI
4. "Computer Networks", 5E, Peterson, Davie, Elsevier.

Reference Books:

1. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRCPublications.
2. "Computer Networks and Internets with Internet Applications", Comer.
3. Computer Networks, A Top-Down Approach, James F. Kurose, Keith W. Ross, 3rd Edition, Pearson.
4. Computer Networks, A Top-Down Approach, Behrouz A. Forouzan, Firoz Mosharraf, Special Indian Edition, McGraw Hill.

Course Title	COMPUTER ORGANIZATION				B.Tech. AI&ML V Sem (Minor Degree)		
Course Code	Hours / Week			Credits	Maximum Marks		
20913902	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- To make the students understand the structure of computers and internal organization of different units like memory, I/O devices, registers.
- To study in detail about the micro operations and implementation of fixed and floating point addition, subtraction, multiplication and division operations.
- To study in detail about pipelining, Memory, I/O organization and multiprocessors.

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

CO1	Understand the Basic concepts of computers and Data representation.
CO2	Understand the concept of Register Transfer and various Micro operations.
CO3	Understand the concept of basic computer organization and design, Micro programmed control and Computer Arithmetic.
CO4	Understand the concept of Pipelining and Memory.
CO5	Understand concept of I/O organization and Multiprocessors.

UNIT-I

Basic Concepts of Computers: Computer Types, Functional units, Basic operational concepts, Bus Structures, Performance. **Data Representation-** Fixed Point Representation, Floating Point Representation.

UNIT-II

Register Transfer and Microoperations: Register Transfer, Bus and memory transfers. Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

UNIT-III

Basic Computer Organization and Design: Instruction codes, Computer instructions, Memory Reference Instructions, Input – Output and Interrupt, Addressing modes. **Micro Programmed Control:** Control memory, Address sequencing, Micro program example, Design of control unit, Hard wired control, Micro programmed control. **Computer Arithmetic:** Addition and subtraction, multiplication Algorithms, Division Algorithms.

UNIT-IV

Pipeline: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISCPipeline.
Memory: Basic concepts, Memory Hierarchy, Cache memory, Performance considerations, Virtual memory.

UNIT-V

Input-Output Organization: Peripheral Devices, Input- Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access (DMA).
Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures.

Text Books:

1. Computer Organization – Carl Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill.
2. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI.
3. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

Reference Books:

1. Fundamentals of Computer Organization and Design, - Sivaraama Dandamudi, Springer Int. Edition.
2. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition, Elsevier.
3. Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, BS Publication.

Course Title	MOBILE APPLICATION DEVELOPMENT				B.Tech. AI&ML VI Sem (Minor Degree)		
Course Code	Hours / Week			Credits	Maximum Marks		
20913902	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Min				End Exam Duration: 3Hrs			

Course Objectives:

- To Understand fundamentals of android operating systems.
- To learn the internals of the Android OS
- To learn the Mobile application development using the Android SDK.

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

CO1	Understand the key features of various Mobile Operating Systems.
CO2	Know essential Android programming concepts
CO3	Develop Android Applications using GUI components
CO4	Demonstrate and implement Database connectivity Applications

UNIT I

Android Introduction and Basics: The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge (ADB), Launching Android Applications on a Handset.

UNIT II

Basic Widgets: Understanding the Role of Android Application Components, Understanding the Utility of Android API, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.

UNIT III

Building Blocks for Android Application Design: Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation.

Utilizing Resources and Media: Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video, Displaying Progress with Progress Bar, Using Assets.

UNIT IV

Using Selection widgets and Debugging: Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control, Using the Debugging Tool: Dalvik Debug Monitor Service(DDMS), Debugging Application, Using the Debug Perspective.

Displaying And Fetching Information Using Dialogs and Fragments: What Are Dialogs?, Selecting the Date and Time in One Application, Fragments, Creating Fragments with java Code, Creating Special Fragments.

UNIT V

Building Menus and Storing Data: Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar.

Using Databases: Using the SQLite Open Helper classs, Accessing Databases with the ADB, Creating a Data Entry Form.

Text Books:

1. Android Programming by B.M Harwani, Pearson Education, 2013.
2. Android application Development for Java Programmers, James C Sheusi, Cengage Learning
3. Android In Action by w.Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz., Dreamtech.
4. Beginning Android 4 Application Development, by Wei-Meng Lee , Wiley India.

Reference Books:

1. Android Programming for Begineers, John Horton, Packt> Publications.
2. Professional Android 4 Application Development, Reto Meier, Wiley.
3. Android Programming: Big Nerd Ranch Guide, Bill Phillips, Chris Stewart, Pearson

Course Title	ARTIFICIAL INTELLIGENCE				B.Tech. AI&ML VI Sem (Minor Degree)		
Course Code	Hours/Week			Credits	Maximum Marks		
20913904	L	T	P	C	Continuous Internal Assessment	End Exams	Total
	4	0	0	4	40	60	100
Mid Exam Duration: 90 Minutes				End Exam Duration: 3Hrs			

Course Objectives:

- To understand how a computer making intelligent decisions.
- To understand the notions of state space representation, heuristic search methods.
- To learn different knowledge representation techniques
- To understand the applications of AI.

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

CO1	Given a search problem, analyze and formalize the problem (as a state space, graph, etc.).
CO2	The ability defines admissible and consistent heuristics and completeness and optimality.
CO3	Analyze and Apply knowledge representation technique.
CO4	Ability to understand uncertainty and Design appropriate Bayes Nets corresponding to the causal relationships and conditional independence of a real world situation
CO5	Design good evaluation functions and strategies for game playing and Understand concept of natural language processing.

UNIT-I:

Introduction to AI: AI Problems History what is an AI Technique. Problem, Problem Space and Search, Heuristic Search Techniques.

UNIT-II:

Knowledge Representation Issues, Predicate Logic, Knowledge Representation using rules.

UNIT –III:

Symbolic reasoning under Uncertainty, Bayesian Networks.

UNIT-IV:

Weak Slot Filler Structures, Strong Slot and Filler Structures, Knowledge Representation summary.

UNIT –V:

Game Playing, Planning, Natural Language processing.

Text Books:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004.
3. Philip C Jackson, Introduction to Artificial Intelligence: Second, Enlarged Edition.
4. Saroj Kaushik. Artificial Intelligence. Cengage Learning, 2011.

Reference Books:

1. Charu C. Aggarwal,Artificial Intelligence,Springer,2021.
2. Adelyn Zhou, Mariya Yao and Marlene Jia Applied Artificial Intelligence: A Handbook for Business Leaders, 2017
3. Peter Norvig, Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp.
4. Dr. Dheeraj Mehrotra,Basics of Artificial Intelligence & Machine Learning
5. Chandra S.S.V,Artificial Intelligence and Machine Learning
6. Denis Rothman, Artificial Intelligence by Example