
Vision and Mission of the Institute

Vision

To be an internationally renowned center for excellence in technical and management education with value-driven quality standards and to contribute our might in realizing India's dream of becoming economic super power.

Mission

To impart quality education in Engineering, Technology and Management at undergraduate and post-graduate levels, aiming to achieve status of best Engineering College, thereby cherish the dreams of the founder Chairman and the aspirations of the student's community in the region to become world class professionals and technocrats.

Regulations for

UG Programs in Engineering (R18UG)

(Effective from 2018-19 for Regular students and from 2019-20 for Later Entry students)

incorporating Amendments as on 15.06.2019

KandulaSrinivasa Reddy Memorial College of Engineering

(Autonomous)

Kadapa 516003 AP

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)
(An ISO 9001-2008 Certified Institution)

KSRM College of Engineering (Autonomous), Kadapa-516003, AP

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KSRM College of Engineering (Autonomous), Kadapa-516003, AP

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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 fieldof 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 R18UG and come into force from Academic Year 2018-19 and exist until superseded by new regulations. These rules are applicable for students who join the institute from academic year 2018-19 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 Majorcourses 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 Communications 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 admission 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 havecore, 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 forall 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 in to 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

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 hei) 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 30 marks for internal assessment and 70 marks for End examination totalling 100 marks

7.2.2 For laboratory/drawing/project work subjects, the allocation is 50 marksfor internal assessment and 50 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 30 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 For each theory subject, including mandatory subjects, the internal assessment shall be done by two midterm tests for 25 marks and assignments for 5 marks. The faculty member of the concerned subject will assess the marks in midterm tests and assignments.

Each midterm test will be of two hours duration and evaluated for 25 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 is the sum of midterm tests 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 awarded zero marks for that assignment

The guidelines for internal assessment are given in Annexure 3

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

7.4 End examinations

7.4.1 End examinations shall be conducted after completion of coursework in each semester

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 shallbe appointed by the Principal

7.4.3 Evaluation of answer scriptsshall 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 twointernal 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 awarded zero marks 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 A+ to D- 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 marks and ii) 40% of marks in internal assessment and End examination marks 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 A+ to D- or F

8.5 Grade X 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	Remark
95-100	A+	10.0	Pass
90-94	A	9.5	Pass
85-89	A-	9.0	Pass
80-84	B+	8.5	Pass
75-79	B	8.0	Pass
70-74	B-	7.5	Pass
65-69	C+	7.0	Pass
60-64	C	6.5	Pass
55-59	C-	6.0	Pass
50-54	D+	5.5	Pass
45-49	D	5.0	Pass
40-44	D-	4.5	Pass
0-39	F	0.0	Fail

-	I	0.0	Result Withheld
-	X	0.0	Absent for End Exam

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 allsubjects of the semester with corresponding credits of subjects as weights.

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.

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

8.10 *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 A+ to D- in that subject. If a student receives fail grade F or X in any subject, she or he must register for supplementary End examination for that subject as and when opportunity arises and improve grade to pass grade

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

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 full fills 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 workload 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

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 earnat 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 subjectswith fail grade either F or X 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

12.5 A student will be allowed to improve grade in any theory subject provided she or he has completed coursework of all semesters but before award of provisional/final degree

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 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 requiredcredit-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 BTech 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 fifth semester. Eligibility criteria are (i) minimum CGPA of 8.0 and (ii) no backlogs, reckoned up to third semester. The Chairperson of the concerned Board of Studies will process the applications and publish the list of eligible students

13.4.3 Additional coursework: Students shall complete an additional 20-credits coursework, in addition to 160 regular credits, in her/his own major during fifth to eighth semesters. The Board of Studies (BoS) of the concerned major shall specify the list of advanced elective subjects for the purpose of honours designation. The elective subjects can be studied either by conventional classroom teaching or as online MOOCs on the recommendation of the Chairperson of the concerned BoS

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 fifth to eighth, 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 fifth to eighth 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 fifth semester. Eligibility criteria are (i) minimum CGPA of 7.5 and (ii) no backlogs, reckoned up to third 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 fifth to eighth 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. The core/elective subjects can be studied either by conventional classroom teaching or as online MOOCs on the recommendation of the Chairperson of the concerned BoS (minor program)

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 fifth to eighth, 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 fifth to eighth semesters, she/he will lose candidature for minor degree

13.6 Degree will be issued under the seal of affiliating University

14.0 Transitory Regulations

14.1 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.

Regulations for Lateral Entry Students under R18UG

(Approved in Academic Council meeting held on 15-06-2019)

1.0 *Title and application*: These rules and regulations may be called R18UG-LE and come into force from academic year 2019-20 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).

2.0 Regulations and curriculum: The regulations and curriculum of R18UG shall be applicable in general with the following modifications:

- 2.1 Entry and duration: The students will be admitted directly into third semester of regular 4-year B.Tech degree course governed by R18UG regulations. The duration of the course is three academic years
- 2.1 Curriculum: Third semester to eighth semester curriculum of R18UG
- 2.2 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

2.3 Requirements for the award of B.Tech degree:

- 2.3.1 Time limit for completion of requirements for award of degree is six academic years from the date of admission
- 2.3.2 Registered and successfully completed all required credit-bearing and mandatory subjects with a total of 122 credits (third semester to eighth semester subjects)
- 2.3.3 Honours/minors designation: shall earn extra 20 credits in addition to 122 credits

3.0 In case of ambiguity in the interpretation of regulations, the decision of the academic council shall be final

Vision and Mission of the Department

Vision

Vision

- To raise the quality of education and to be an effective human resource development section under all changing conditions.
- To contribute to the growth of the engineering profession maintaining highest ethical and professional standards.
- To serve the community for its enrichment and advancement
- To fulfill the noble cause of our college management for giving quality education

Mission

.**Mission**

- To produce well disciplined more intelligent and honest Mechanical Engineers.
- To see that our students become assets to the establishments where they are employed and to see that they become proud citizens of the country.

Program Educational Objectives (PEOs):

- Our graduates have the ability to adopt contemporary technologies in Mechanical Engineering to cater the needs of the society
- Our graduates have the ability to apply the knowledge gained from modern design methodologies to address current technical issues
- Our graduates emphasize on high degree of ethics and standards while executing multi disciplinary engineering projects; they also consider economic environmental and social issues while executing such projects

Program me Outcomes(POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program me Specific Outcomes

PSO 1: Apply their knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology.

PSO 2: Successfully apply the principles of design, analysis and implementation of mechanical systems/processes which have been learned as a part of the curriculum.

PSO 3: Develop and implement new ideas on product design and development with the help of modern CAD/CAM tools, while ensuring best manufacturing practices.

K.S.R.M.COLLEGE OF ENGINEERING,KADAPA.

DEPARTMENT OF MECHANICAL ENGINEERING

I SEM R-18(Mechanical)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1821101	BSC	Mathematics - I	3	1	0	30	70	4
1823102	BSC	Engineering Chemistry	3	1	0	30	70	4
1824103	HSMC	English	2	0	0	30	70	2
1805104	ESC	Programming for Problem Solving	3	0	0	30	70	3
1823107	BSC	Chemistry Lab	0	0	3	50	50	1.5
1805108	ESC	Programming for Problem Solving Lab	0	0	4	50	50	2
1824109	HSMC	English Lab	0	0	2	50	50	1
		Total	11	2	9	270	430	17.5

Second Semester (mechanical)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1821201	BSC	Mathematics - II	3	1	0	30	70	4
1822204	BSC	Engineering Physics	3	1	0	30	70	4
1802205	ESC	Basic Electrical Engineering	3	1	0	30	70	4
1803207	ESC	Engineering Graphics & Design	1	0	4	50	50	3
1822208	BSC	Engineering Physics Lab	0	0	3	50	50	1.5
1802209	ESC	Basic Electrical Engineering Lab	0	0	2	50	50	1
1803211	ESC	Workshop and Manufacturing Practices	1	0	4	50	50	3
		Total	11	3	13	290	410	20.5

Semester III [Second year]

S. NO	Course Code	Subject code	Course Title	Hours per week			IM	EM	Total contact hours	credits
				L	T	P				
1	**BSC 301**	**1823301**	**Biology for Engineers**	**3**	**0**	**0**	**30**	**70**	**3**	**3**
2	**BSC**	**1821302**	**Numerical methods, probability and statics**	**2**	**0**	**0**	**30**	**70**	**2**	**2**
3	**ESC 301**	**1801303**	**Engineering Mechanics**	**3**	**0**	**0**	**30**	**70**	**3**	**3**
4	PCC-ME	**1803304**	Manufacturing Process	3	0	0	30	70	3	3
5	PCC-ME	**1803305**	Strength of materials	3	0	0	30	70	3	3
6	PCC-ME	**1803306**	Material science and engineering	3	0	0	30	70	3	3
7	PCC-ME	**1803307**	Thermodynamics	3	0	0	30	70	3	3
8	PCC	**1803308**	Material science, Mechanics of solids Lab	0	0	3	50	50	3	1
9	PCC	**1803309**	Manufacturing technology Lab	0	0	3	50	50	3	1
					Total credits					**22**
					Total Hours					**26**

Semester IV (Second Year)

S. NO	Course Code	Subject code	Course Title	Hours per week			IM	EM	Total contact hours	credits
				L	T	P				
1	PCC-ME	**1803401**	Applied Thermodynamics	3	0	0	30	70	3	3
2	PCC-ME	**1803402**	Fluid Mechanics &Fluid Machinery	3	0	0	30	70	3	3
3	PCC-ME	**1803403**	Kinematics of Machinery	3	0	0	30	70	3	3
4	**ESC**	**1814404**	**Basic Electronic Engineering**	**3**	**1**	**0**	**30**	**70**	**4**	**4**
5	PCC-ME	**1803405**	Instrumentation and control systems	3	0	0	30	70	3	3
6	PCC-ME	**1803406**	Computer Aided Machine Drawing	1	0	2	50	50	3	2
7	**ESC**	**1803407**	**Basic Electronics & MOF Lab**	0	0	3	50	50	3	1.5
8	MC-I	**18994M1**	Environmental Science	2	0	0	30	0	2	0
9	PCC – ME	**1803408**	Seminar/Industrial Training	0	0	1	100	0	1	1
10	HMSC-	**1824409**	Advanced English communication Lab	0	0	3	50	50	03	1.5
									Total credits	**22**
									Total Hours	**27**

Semester V (Third Year) R-18

S.NO	Course Code	Subject code	Course Title	Hours per week			IM	EM	Total contact hours	credits
				L	T	P				
1	PCC- ME	**1803501**	Heat Transfer	3	0	0	30	70	3	3
2	PCC- ME	**1803502**	DME-I	3	0	0	30	70	3	3
3	PCC-ME	**1803503**	Metrology	3	0	0	30	70	3	2
4	PCC- ME	**1803504**	Dynamics of Machinery	3	0	0	30	70	3	3
5	**HSMC**	**1825505**	**Managerial Economics**	**3**	**0**	**0**	**30**	**70**	**3**	**3**
6	**ME PEC**	**1803506**	**1. Automobile engineering (Professional Elective-I)**	**3**	**0**	**0**	**30**	**70**	**3**	**3**
	PEC	**1803507**	2. Mechanical behavior of metals	3	0	0	30	70	3	3
	PEC	**1803508**	3. Renew enable technologies	3	0	0	30	70	3	3
	PEC	**1803509**	4. Supply Chain Management	3	0	0	30	70	3	3
	PEC	**1803510**	5. Manufacturing Methods in precision engineering	3	0	0	30	70	3	3
	PEC	**1803511**	6. Design for manufacturing	3	0	0	30	70	3	3
7	AU1	**1803512**	Additive	0	0	3	30		3	0

			manufacturing							
8	PCC-ME	**1803513**	Mechanical Engg Lab(Thermal –I)	0	0	3	50	50	3	1.5
9	PCC-ME	**1803514**	Mechanical Engg Lab(CAD Lab)	0	0	3	50	50	3	1.5
10	Project-I	**1803515**	Socially relevant project	0	0	0	50	50	0	2
									Total credits	**22**
									Total Hours	**27**

Semester VI (Third Year)

S. NO	Course Code	Subject code	Course Title	Hours per week			IM	EM	Total contact hours	credits
				L	T	P				
1	PCC-	**1803601**	Machine tools	3	0	0	30	70	3	3
2	PCC-	**1803602**	DME-II	3	0	0	30	70	3	3
3	PCC	**1803603**	Operations Research	3	0	0	30	70	3	3
4	PCC	**1803604**	Power Plant engineering	3	0	0	30	70	3	2
5	**PEC- II**	**1803605**	Gas turbine and jet propulsion systems	**3**	**0**	**0**	**30**	**70**	**3**	**3**
	PEC- II	**1803606**	Computer aided process planning	3	0	0	30	70	3	3
	PEC- II	**1803607**	Concurrent Engineering	3	0	0	30	70	3	3
	PEC- II	**1803608**	Introduction to Artificial Intelligence & Expert systems	3	0	0	30	70	3	3
	PEC- II	**1803609**	Virtual Reality Systems	3	0	0	30	70	3	3
	PEC- II	**1803610**	Autotronics	3	0	0	30	70	3	3
6	**OEC-I**	**180E301**	Energy Systems Engineering	3	0	0	30	70	3	3
	OEC-I	**180E302**	Robotics And Application In Manufacturing	3	0	0	30	70	3	3
7	PCC-	**1803613**	**Machine tools Lab**	0	0	3	50	50	3	1.5
8	PCC-	**1803614**	**Heat Transfer Lab**	0	0	3	50	50	3	1.5

9	Project-II	**1803615**	Internship	0	0	0	100	0	0	2
10	MC-II	**1825616**	Organizational behaviour	2	0	0	30	0	2	0
11	HSMC AU II	**1824617**	Professional Ethics and soft skills	2	0		30		0	0
					Total credits					**22**
					Total Hours					**25**

Semester VII (Fourth Year)

S. NO	Course Code	Subject code	Course Title	Hours per week			IM	EM	Total contact hours	credits
				L	T	P				
1	PCC	**1803701**	CAD/CAM	3	1	0	30	70	3	3
2	PCC	**1803702**	Finite Element Methods	3	0	0	30	70	3	2
		1803703	Quality engineering &management	3	0	0	30	70	3	2
3	**PEC- III**	**1803704**	**Production and operation management** **(Professional Elective-III)**	**3**	**0**	**0**	**30**	**70**	**3**	**3**
		1803705	**Rapid prototyping**	**3**	**0**	**0**	**30**	**70**	**3**	**3**
		1803706	Mechatronics	3	0	0	30	70	3	3
		1803707	Flexible manufacturing systems	3	0	0	30	70	3	3
		1803708	**Computer Graphics**	**3**	**0**	**0**	**30**	**70**	**3**	**3**
		1803709	Industrial safety	3	0	0	30	70	3	3
4	**OEC- II**	**180E303**	Industrial safety & management	3	0	0	30	70	3	3
	OEC- II	**180E304**	Smart materials	3	0	0	30	70	3	3
5	**OEC -III**	**180E305**	Quantitative analysis for business decisions	3	0	0	30	70	3	3
	OEC -III	**180E306**	Entrepreneurship	3	0	0	30	70	3	3
6	PCC- ME 703	**1803714**	Metrology Lab	0	0	3	30	70	3	1.5
7	PCC ME704	**1803715**	Instrumentation &Control Systems Lab	0	0	3	50	50	3	1.5
8	Project-III	**1803716**	Minor Project	0	0	5	100	00	5	3
09	AUII	**1803717**	**Introduction to ANSYS**	0	0	2	50	0	2	0

					Total credits	**22**
					Total Hours	**28**

Semester VIII(Fourth Year)

S. NO	**Course Code**	**Subject code**	**Course Title**	**Hours per week**			**IM**	**EM**	**Total contact hours**	**credits**
				L	**T**	**P**				
1	**PEC- IV**	**1803801**	**Refrigeration and air conditioning** **(Professional Elective-IV)**	**3**	**0**	**0**	**30**	**70**	**3**	**3**
		1803802	Modern manufacturing Methods	3	0	0	30	70	3	3
		1803803	Composite & Nano materials	3	0	0	30	70	3	3
		1803804	Introduction to Expert systems	3	0	0	30	70	3	3
		1803805	Computer Aided Process Planning	3	0	0	30	70	3	3
		1803806	Reliability in engineering	3	0	0	30	70	3	3
2	**OEC -IV**	**1803807**	Total quality management	**3**	**0**	**0**	**30**	**70**	**3**	**3**
		1803808	Introduction to IC engines	**3**	**0**	**0**	**30**	**70**	**3**	**3**
3	Project-IV	**1803813**	Major Project	0	0	12	50	50	12	5
4	Seminar-II	**1803814**	Seminar-II	0	0	1	100	0	01	1
									Total credits	**12**
									Total Hours	**19**

I SEM R-18(Mechanical)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1821101	BSC	Mathematics - I	3	1	0	30	70	4
1823102	BSC	Engineering Chemistry	3	1	0	30	70	4
1824103	HSMC	English	2	0	0	30	70	2
1805104	ESC	Programming for Problem Solving	3	0	0	30	70	3
1823107	BSC	Chemistry Lab	0	0	3	50	50	1.5
1805108	ESC	Programming for Problem Solving Lab	0	0	4	50	50	2
1824109	HSMC	English Lab	0	0	2	50	50	1
		Total	11	2	9	270	430	17.5

Course Title	**MATHEMATICS – I**				**B. Tech. I Sem** *(Common to All Branches)*		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1821101	**BSC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	4	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

To enable the students to apply the knowledge of mathematics in various engineering fields by making them to learn the following:

- The essential tool of matrices in a comprehensive manner.
- The convergence of series.
- Maxima and minima of a function and the radius of curvature
- The Jacobians and extreme values of a function.
- Evaluate the definite integrals, Beta and Gamma functions. Apply Fourier series in engineering problems.

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

CO 1	**Apply** the essential tool of matrices in a comprehensive manner.(L3)
CO 2	**Describe** the convergence of series.(L2)
CO 3	**Classify** the functions of several variables which is useful in optimization techniques.(L4)
CO 4	**Define** Beta and gamma functions and solve definite integrals. (L1)
CO 5	**Determine** the Fourier series of the functions. (L3)

UNIT I

Matrices: (14 Hours)

Basic definitions of Symmetric, skew-symmetric and orthogonal matrices – Elementary transformations – Rank – Echelon form, Normal form– System of linear equations –Eigen values and Eigen vectors for real matrices – Cayley-Hamilton theorem – Diagonalization of matrix by orthogonal transformation.

UNIT II

Sequences and series: (8 Hours)

Convergence of sequences and series – Comparison test – p test – D'Alemberts ratio test – Cauchy's root test. Power series – Series for exponential, trigonometric and logarithm functions.

UNIT III

Differential Calculus: (10 Hours)

Taylor's and Maclaurin's series – Maxima and minima of single variable – Curvature: Curvature of a curve – Curvature of a circle – Radius of a curvature – Centre of Curvature – Equation to the circle of curvature.

UNIT IV

Multivariable Calculus: (10 Hours)

Functions of two or more variables – Partial derivatives, Total derivative – Jacobians – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V

Integral Calculus: (12 Hours)

Evaluation of definite integrals – Beta and Gamma functions and their properties. Fourier series: Half range Fourier sine and cosine expansions – Parseval's theorem.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-43 edition 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9th edition- 2013.
3. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, Pearson, 9th Edition, Reprint, 2002.

Reference Books:

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

Course Title	ENGINEERING CHEMISTRY				B. Tech. CE,ME & EEE -I Sem ECE & CSE - II Sem			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1823102	BSC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	1	--	4	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- Knowledge in Chemistry serves as basic nutrient for the understanding and thereby designs of materials of importance in life. Thus the advancement in Engineering depends on the outcome of basic sciences.
- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial! Engineering applications.
- The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry principles (or) applications in the field of engineering.
- An attempt has been made to logically correlate the topic with its application.
- After the completion of the course, the student would understand about the concepts of chemistry.

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

CO 1	**Remember** the major chemical reactions that are used in the synthesis and stereochemistry of Molecules.
CO 2	**Understand** the periodic properties such as ionization potential, electro negativity and oxidation states.
CO 3	**Determine** the ranges of the electromagnetic spectrum used for exciting different molecular Energy levels in various spectroscopic techniques.
CO 4	**Analyze** microscopic chemistry in terms of atomic and molecular orbital and intermolecular forces. .
CO 5	**Outline** the properties of metals, water and thermodynamic considerations.

UNIT-I

Atomic and molecular structure

Schrodinger wave equation. Particle in a box (one dimensional) and their applications .Molecular orbital's of diatomic molecules and plots of the multicenter orbital's. Equations for atomic and molecular orbital's .Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties .Band structure of solids and the role of doping on band structures.

UNIT-II

Periodic properties

Effective nuclear charge, penetration of orbital's, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers and geometries, hard, soft acids and bases.

UNIT-III

Intermolecular forces

Ionic, dipolar and van DerWaals interactions. Equations of state of real gases and critical phenomena.

Use of free energy in chemical equilibria

Thermodynamic functions: Introduction, define energy, entropy, Free energy. Free energy and emf. Cell potentials, Nernst equation and applications .Water chemistry-types of water and Boiler troubles. Corrosion-types of corrosion and factors influencing corrosion.

UNIT-IV

Spectroscopic techniques and applications

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules.

UNIT-V

Stereochemistry

Representations of 3 dimensional structures, structural isomers and stereo isomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of Cyclohexane.

Simple Organic Reactions

Introduction to reactions involving Substitution(SN^1 &SN^2), Addition Reactions involving C=C(Markonikoffreaction)&C=O(Grignardreagent),Elimination(E_1&E_2)Oxidation(Baeyer villiger reaction),Reduction(Clemmensen reduction).

Text Books:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. A Text Book of Engg. Chemistry, ShashiChawla, DhanpatRai& Co. (P) Ltd.
3. . Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
4. Applied Chemistry, Sunita Rattan, Kataria

5. Engineering Chemistry, Baskar, Wiley

6. . Engineering Chemistry – I, D. GrourKrishana, Vikas Publishing

7. . Laboratory Manual Engg. Chemistry, Anupma Rajput, DhanpatRai& Co.

Course Title Course Code	English				B. Tech. ME I Sem		
	Category	Hours/Week		Credits	Maximum Marks		
1824103	Humanities and social sciences	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	--	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

➢ To facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers

➢ To focus on appropriate reading strategies for better understanding of various academic texts and authentic material.

➢ To help improve speaking skills through participation in activities such as role plays, group discussions and structured talks/oral presentations.

➢ To impart effective strategies for good writing so as to make the essays, paragraphs, reports … etc. effective.

➢ To provide knowledge of sentence structures and vocabulary and encourage their appropriate use in speaking and writing grammatically.

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

CO 1	**Describe** the classification of words, sentences and their usages in sentences.
CO 2	**Understand** the difference between spoken and written English.
CO 3	**Analyze** the rules in language for changing the form of sentences.
CO 4	**Illustrate** the factors that influence grammar and vocabulary in speaking and writing
CO 5	**Classify** the parts of speech, tenses and sentence structures

Syllabus:

UNIT - 1: Vocabulary Building

1.1 The concept of Word Formation

1.2 Root word from foreign languages and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

1.4 Synonyms, antonyms

1.5 Idioms and phrases.

UNIT - 2: Basic Writing Skills

1.6 Sentence Structures

1.7 Use of phrases and clauses in sentences

1.8 Importance of proper punctuation

1.9 Creating coherence

1.10 Organizing principles of paragraphs in documents

1.11 Techniques for writing precisely

UNIT - 3 : Transformation

1.12 Interchange of parts of speech

1.13 Active voice and Passive voice

1.14 Direct and Indirect speech

1.15 3.4Degrees of comparison

1.16 3.5Simple, compound and complex sentences

UNIT - 4: Identifying Common Errors in Writing

4.1 Subject-Verb agreement

4.2 Noun-pronoun agreement

4.3 Misplaced modifiers

4.4 Articles

4.5 Prepositions

4.6 Redundancies

4.7 Clichés

4.8 Tenses

UNIT - 5 : Reading and Writing Practices

4.9 Comprehension

4.10 Précis Writing

4.11 Essay writing

Suggested Readings:

(i) Practical English Usage. Michael Swan. OUP. 1995.

(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007

(iii)On Writing Well. William Zinsser. Harper Resource Book. 2001

(iv)Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

(vi)Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Course Title	PROGRAMMING FOR PROBLEM SOLVING					(CE, ME, EEE- I SEM)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1805104	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	--	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- Understand the concepts of algorithm and use it to solve computational problems
- Understand programming skills using the fundamentals and basics of C Language
- Acquire basic knowledge to use proper control structure to solve real world problems
- Improve problem solving skills using arrays, strings, and functions.
- Understand memory utilization and organize heterogeneous data properly

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

CO 1	Understand the basics of computer system and C programming.
CO 2	Analyze a given problem and develop an algorithm to solve the problem.
CO 3	Apply proper branching and loop constructs to solve a complex problem
CO 4	Understand the concepts of arrays and strings to solve real time applications
CO 5	Apply modular approaches for solving complex problems
CO 6	Illustrate memory optimization for solving real world problems using structures and Unions

UNIT-I

Introduction to Computers: - Introduction, computer hardware and software, creating and running programs, software development life cycle, algorithms, flowcharts.

Introduction to C programming: - Overview of C, structure of a C program, variables, constants, data types, identifiers, keywords, Input/output statements in C, programming examples.

UNIT-II

Operators and Expressions:- Operators, expressions, precedence and associativity, evaluating expressions, type conversion, typedef, enumerations.

Decision making statements: if statement, if-else statement, nested if-else statement, switch statement.

Loops in C: while loop, for loop, do-while loop, nested for loops,

Jumping statements: break, continue and goto statements.

UNIT-III

Arrays: Introduction, Declaration and initialization of 1D and 2D arrays.

Array applications: -bubble (exchange) sort, selection sort, linear search, binary search.

Strings: -Definition, declaration and initialization of strings, string I/O functions, string handling functions, array of strings (table of strings).

UNIT-IV

Functions: introduction, category of functions, parameter passing methods, storage classes, recursive function.

Pointers: Understanding pointers, declaring and initialization of pointer variable, accessing the address of variables, accessing a variable through its pointer, chain of pointers.

UNIT-V

Structures and union: Introduction, defining a structure, declaring structure variable, structure initialization, accessing members of structure, copying and comparing structure variables, structures within structures, array of structures, and introduction of union.

Text Books:

1. E. Balagurusamy, Programming in ANSI C, Fifth Edition, McGraw Hill.
2. Rema Theraja, Programming in C, second edition, Oxford.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. R.G. Dromey, How to solve it by Computer, Pearson.
3. Yashavant Kanetkar, Let us C, 15th edition, BPB Publications.
4. Dr. P. ChennaReddy, Computer Fundamentals and C Programming, Second Edition.

Course Title	ENGINEERING CHEMISTRY LAB				B. Tech. CE,ME & EEE -I Sem ECE & CSE - II Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1823107	**BSC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		--	--	3	1.5	50	50	100
						End Exam Duration: 3Hrs		

Course Objectives:

- The student will have exposure to various experimental skills which is very essential for an Engineering student.
- The experiments are selected from various areas of chemistry like Water, polymers, colligative properties and conductometry.
- Also the student is exposed to various tools like Analytical Balance, Viscometer, conductometer ,etc.

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

CO 1	**Compare** rate constants of reactions from concentration of reactants/products as a function of time.
CO 2	**Evaluate** molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
CO 3	**Analyze** of drug molecule and salt sample.
CO 4	**Determine** the quantity of water sample by estimation of hardness of water, chloride content, DO , etc.

Choice Of Experiments from the following:

1. Estimation of Hardness of Water present in given water sample by EDTA method.
2. Determination of surface tension and viscosity.
3. Determination of chloride content of water.
4. Colligative properties using freezing point depression.
5. Estimation of Dissolved Oxygen present in given water sample by Winkler's method.
6. Potentiometry - determination of Redox potentials and emfs.
7. Synthesis of a polymer/drug.
8. Saponification/acid value of an oil.
9. Determination of cell constant and conductance of solutions..
10. Chemical oscillations- Iodine clock reaction.
11. Determination of the partition coefficient of a substance between two immiscible liquids.

12. Adsorption of acetic acid by charcoal.

Text Books:

1. Laboratory Manual Engg. Chemistry, Anupma Rajput, DhanpatRai& Co.

3. Vogel's Text book of Quantitative chemical Analysis, J.Mendham et.al., Pearson Education,

Course Title	PROGRAMMING FOR PROBLEM SOLVING LAB					(CE, ME, EEE- I SEM)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1805108	**PC**	**L**	**T**	**P**	**C**	**Continuous**	**End**	**Total**

						Internal Assessment	**Exams**	
		0	--	4	2	50	50	100
					End Exam Duration: 3Hrs			

Course Objectives:

- Develop readable and efficient C programs for computational problems
- Construct a C-program using language constructs such as Operators, Conditional and Iterative Statements to solve real complex problems
- Develop modular C programs for large problems
- Develop optimized programs to solve real world problems

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

CO 1	Analyze given problem and develop an algorithm
CO 2	Implement Code and debug programs in C language using various constructs
CO 3	Choose proper C language constructs to solve complex problems.
CO 4	Organize and implement heterogeneous data in efficient memory utilization

The student is expected to solve at least 12 assignments from different concepts. (Every year 12 different experiments).

DOS commands, Algorithms, Flowcharts and sample C programs

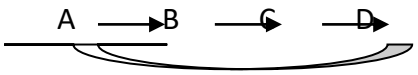
1. Practice DOS commands necessary for design of C programs.

2. Design and develop algorithms and flowcharts for simple and logical problems

3. Write a C program to convert a given integer (in days) to years, months and days, assumes that all months have 30 days and all years have 365 days.

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

5. Write a C program to implement the following exchanges.



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

Problems involving if-then-else structures

7. Write a C program to find out whether a given number is even number or odd number.

8. Write a C program to check whether a given year is leap year or not.

9. Design and develop an algorithm that takes three coefficients (***a***, ***b***, and ***c***) of a Quadratic equation ($ax^2+bx+c=0$) as input and compute all possible roots. Implement a C program for the developed algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages.

10. Write a C program that reads three floating values and check if it is possible to make a triangle with them. Also calculate area and perimeter of the triangle if the said values are valid.

11. Write a C program to read the coordinates(x, y) (in Cartesian system) and find the quadrant to which it belongs (Quadrant -I, Quadrant -II, Quadrant -III, Quadrant -IV).

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

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

13. A library charges fine for every book returned late. For first five days the fine is 50 paisa, for 6-10 days fine is one rupee and above 10 days fine is 5 rupees. If you return the book after 30 days your membership will be cancelled. Write a C program to accept the number of days that the member is late to return the book and display the fine or appropriate message.

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

Problems involving Looping statements

15. If the sum of the cubes of each digit of a number is equal to the number itself, then the number is called Armstrong number. (for example, $153 = 1^3+5^3+3^3$). Design and develop an algorithm to find whether a given number is Armstrong number or not. Implement a C program for the developed algorithm.

16. The total distance travelled by vehicle in 't' seconds is given by **distance = ut+1/2at^2** where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec^2). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

17. Write a C program that takes two positive numbers 'a' and ' b ' where (a ≤b). For each integer n, a ≤n ≤b.
    - If 1≤n≤9,, then print the English representation of it in lowercase. That is "one" for , "two" for , and so on.
    - Else if n > 9 and it is an even number, then print "even".
    - Else if n > 9 and it is an odd number, then print "odd

    [Input: 8 11 Output: Eight Nine Even Odd]

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

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

20. Write a C program to evaluate the sin(x) function series

$$\sin x = \frac{x}{1!} - \frac{x3}{3!} + \frac{x5}{5!} - \frac{x7}{7!} + \cdots$$

21. **Fibonacci Sequence**

    A Fibonacci sequence is defined as follows:

    The first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a program to generate the first N terms of the sequence.

Arrays

22. Write a C program to find the smallest and largest number in a given array.

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

24. Write a C program to sort the list of elements using
    a) Bubble Sort b) Selection sort.

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

a) Linear search b) Binary search

26. Write a C program to find the transpose of a matrix.

27. Write a C program to read two matrices and perform the following operations
    a) Addition of two matrices
    b) Multiplication of two matrices

Additional Problems on arrays

28. **Partitioning an array**
    Given a randomly ordered array of n elements, write a C program to partition the elements into two subsets such that elements ≤X are in one subset and elements ≥X are in another subset.
29. **Finding the k^{th} smallest element**
    Given a randomly ordered array of n elements, write a C program to determine the k^{th} smallest element.

30. **Array order reversal**
    Write a C program to rearrange the elements in an array so that they appear in reverse order.

Strings

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

32. Write a C program to sort the names of students in a class in alphabetical order.

Additional Problems on strings

33. Write a C program to read two strings and perform the following operations without using built string library functions.
    i) String length
    ii) String reversing
    iii) Comparison of two strings
    iv) Concatenation of two strings

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

Functions and Recursion

35. Write a C program to swap the contents of two variables using
    a) Call by value
    b) Call by reference.

36. Write a C program using recursion to
    a) Find the factorial of a given number
    b) Print the Fibonacci series up to a given number.
    c) Find the GCD of two integers.

Structures

37. Write a C program to define a structure with the following members.
    Roll No., Name, marks in Sub1, Sub2, Sub3. Read the n students records and find the total marks of each student and print the result in the following format.

Roll No	Name	Sub1	Sub2	Sub3	Total marks	result
189Y1A0501	Kavya	80	70	75	225	Distinction

Files

38. Write a C program to copy the contents of one file to another file.

Text Books:

1. YashavantKanetkar, Let us C, 15th edition, BPB publications.
2. E. Balagurusamy, Programming in ANSI C, Fifth Edition, McGraw Hill.
3. R.G. Dromey, How to solve it by Computer, Pearson.

Course Title	**English Language and Communication Skills Lab**				**B. Tech. ME I Sem**		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
1824109	**Humanities and social sciences**	**L**	**T**	**P**	**C**	**Internal Assessment**	**External Exams**	**Total**
		--	--	3	2	50	50	100
					End Exam Duration: 3Hrs			

Course Objectives:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize their mother tongue
- To train students to use language appropriately for public speaking, group discussions and influence interviews.

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

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

Syllabus:

- Oral Communication (This unit involve interactive practice sessions in Language Lab)
- Listening Comprehension ----- Language Lab
- Pronunciation, Intonation, Stress and Rhythm ----- Language Lab
- Everyday Situations: Conversations and Dialogues ------ Communication Lab
- Communication at workplace ------ Communication Lab
- Interviews ------ Communication Lab
- Formal Presentations ------ Communication Lab

Suggested Software:

1) Cambridge Advanced Learners' English Dictionary with CD.
2) Grammar Made Easy by Darling Kindersley.
3) Punctuation Made Easy by Darling Kindersley.
4) Oxford Advanced Learner's Compass, 8th Edition.
5) English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
6) English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
7) TOEFL and GRE (KAPLAN, AARCO and BARRONS, USA, Cracking GRE by CLIFFS).

Evaluation of the E.L.C.S Lab:

Internal Evaluation : 50 Marks

External Evaluation: 50 marks

1. The following are the parameters for evaluating internal assessment:

- Regularity of the student/ attendance to the lab 10 Marks
- Completion of the day to day task and getting signature 15 Marks
- Testing the knowledge by posing related questions 10 Marks
- Lab manual record submission 15 Marks

Total Marks for Internal Evaluation 50 Marks

2**. External Examination assessment: (3 Hrs**)

- Examination 30 Marks
- Record 10 Marks
- Viva-voce 10 Marks

Total Marks for External Evaluation 50 Marks

Second Semester

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1821201	BSC	Mathematics - II	3	1	0	30	70	4
1822204	BSC	Engineering Physics	3	1	0	30	70	4
1802205	ESC	Basic Electrical Engineering	3	1	0	30	70	4
1803207	ESC	Engineering Graphics & Design	1	0	4	50	50	3
1822208	BSC	Engineering Physics Lab	0	0	3	50	50	1.5
1802209	ESC	Basic Electrical Engineering Lab	0	0	2	50	50	1
1803211	ESC	Workshop and Manufacturing Practices	1	0	4	50	50	3
		Total	11	3	13	290	410	20.5

<table>
<tr><td>Course Title</td><td colspan="5">MATHEMATICS – II</td><td colspan="3">B. Tech. I Sem
(Common to All Branches)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1821201</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>--</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
To enable the students to apply the knowledge of mathematics in various engineering fields by making them to learn the following:
• First order differential equations.
• Linear differential equations with constant coefficients.
• Laplace transforms in engineering problems.
• Evaluate multiple integrals.
• Understand Vector Calculus concepts and their applications.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Solve the first order and higher order linear differential equations with constant coefficients.(L3)</td></tr>
<tr><td>CO 2</td><td colspan="8">Apply Laplace Transforms in engineering problems.(L3)</td></tr>
<tr><td>CO 3</td><td colspan="8">Evaluate multiple integrals.(L5)</td></tr>
<tr><td>CO 4</td><td colspan="8">Understand Vector Calculus concepts and analyze their applications in engineering</td></tr>
</table>

	problems. (L4)

UNIT I

First order ordinary differential equations: (10 Hours)
Linear, Bernoulli equations, Exact and equations reducible to Exact. Applications: Orthogonal trajectories, Newton's law of cooling, Law of natural growth and decay.

UNIT II

Ordinary differential equations of higher order: (10 Hours)
Linear differential equations of second and higher order with constant coefficients – R.H.S term of the type e^{ax}, sinax, cosax, polynomials in x, e^{ax} V(x), xV(x) – Method of variation of parameters.

UNIT III

Laplace transforms: (12 Hours)

Laplace transforms of standard functions – Properties of Laplace Transforms – Transforms of derivatives and integrals – Evaluation of integrals by Laplace transforms – Laplace transform of periodic functions. Convolution theorem. Inverse Laplace Transforms – Applications of Laplace transforms to ordinary differential equations.

UNIT IV

Multiple Integrals: (10 Hours)
Evaluation of double integrals in Cartesian coordinates and polar coordinates – Change of variables in double integrals – Change the order of integration in double integrals – Evaluation of triple integrals in Cartesian and polar coordinates – Change of variables in triple integrals.

UNIT V

Calculus: (12 Hours)
Vector differentiation: Scalar point function - Vector point function – Vector operator Del – Gradient – Divergence – Curl. Vector integration: Line, Surface and Volume integrals. Green's theorem in a plane, Stoke's theorem and Gauss-divergence theorems (Statements only). Applications of Green's, Stoke's and Gauss divergence theorems.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-43 edition 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9th edition- 2013
3. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, Pearson, 9th Edition, Reprint, 2002.

Reference Books:

1. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt. Ltd, New Delhi, 11th Edition, Reprint 2010.
2. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, Lakshmi Publications, Reprint 2008.

Course Title	ENGINEERING PHYSICS				B. Tech. ME II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1822204	BSC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	1	0	4	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

1. Expose students to theoretical and mathematical aspects of Interference, Diffraction techniques and Lasers for testing of materials.
2. To understand the concepts of Simple harmonic Oscillator & non dispersive Transverse & Longitudinal waves .
3. Develop knowledge and understanding the fundamental concepts of solids and semiconductors.
4. Adaptability to new developments in science and technology.

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

CO 1	**Apply** the knowledge of Sciences to solve engineering problems by using Interference and Diffraction techniques.(**L_1**)
CO 2	**Understand** and Solve Transverse & Longitudinal waves. (**L_2**)
CO 3	**Able** to understand and Compute Damped & Forced Simple Harmonic Oscillations.(**L_3**)
CO 4	**Analyze** to identify and formulate the working elements of different lasers and estimate laser operation parameters.(**L_4**)

Course Syllabus:

Unit I: Wave Optics

Introduction, Huygens' Principle, Superposition of waves, Young's double slit experiment, expression for fringe width, interference in thin film by reflection, Newton's rings experiment, Diffraction Fraunhofer diffraction due to single slit, and Diffraction grating (N-slits).

(10 lectures)

Unit II: Lasers

Introduction to lasers, characteristics of laser, interaction of radiation with matter-spontaneous and stimulated emission, Einstein's coefficients; population inversion, excitation mechanisms, types of lasers: Solid-state lasers – Nd-YAG laser, Gas lasers - He-Ne Laser, Semiconductor p-n junction diode laser, Applications of lasers

(08 lectures)

Unit III: Damped and Forced Simple Harmonic Oscillator

Mechanical and electrical simple harmonic oscillators, Damped harmonic oscillator – Heavy, critical and light damping, Energy decay in a damped harmonic oscillator, Quality factor, Forced Mechanical and Electrical oscillators, Electrical and Mechanical impedance.
(10 lectures)

UNIT IV

Non-dispersive transverse and longitudinal waves in one dimension String

Transverse wave on a string, the wave equation on a string, Harmonic waves, Reflection and transmission of waves at a boundary, Impedance matching, Standing waves and their Eigen frequencies, Longitudinal waves and the wave equation for them.

(08 lectures)

Unit V: Solids & Semiconductors

Introduction, Free electron theory of metals (drift velocity and electrical conductivity), Fermi-Dirac distribution, Kronig-Penney model and origin of energy bands, band structure of metals, semiconductors, and insulators. Direct and indirect band gap semiconductors, Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), diffusion and drift, p -n junction.

(10 lectures)

Text Books:

1. Engineering Physics by **K. Thyagarajan**, Mac Graw – Hill Publishing Co. New Delhi.

2. ‘ Oscillations and waves in physics’, Ian G. Main.

Reference Books:

1. The physics of vibrations and waves, ‘H.J. Pain’.

2. Semiconductor Physics & Devices, ‘Neamen’.

Course Title	Basic Electrical Engineering				B. Tech. ME II Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1802203	**Engineering Sciences (ESC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	0	4	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

The objective of the course is to learn the concepts of circuit analysis which includes DC excitations and AC excitations, different types of DC generators, motors which are widely used in industry, Construction and working principle of 1-F Transformers & 3-F Induction Motors ,Components of low tension switchgear.

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

CO 1	Understand basic electric circuits and network solving techniques.
CO 2	Analyze RL, RC and RLC circuits for AC excitations.
CO 3	Understand working principle, operation and construction of DC machines, 3-Ø induction motors and 1-Ø transformers
CO 4	Understand the components of low voltage electrical installations
CO 5	Solve the problems on EMF,Current ,Torque ,Regulation and Efficiency of DC machines ,3-Ø induction motor and 1-Ø transformer.

Course Syllabus:

UNIT – I **DC Circuits :** Electrical circuit elements (R, L and C), voltage and current sources – source transformation, Series & Parallel networks - Star-Delta transformation, Kirchhoff's current and voltage laws, Mesh and Nodal analysis of simple circuits with DC -Problems.

UNIT – II **AC Circuits:** Representation of sinusoidal waveforms, average, peak and rms values, Form factor Peak factor for sinusoidal waveform - problems, phasor-phasor representation, impedance, admittance, reactance, susceptance, real power, reactive power, apparent power, power factor. Analysis of 1Φ ac circuits for series & parallel combinations - simple problems.

UNIT – III **DC machines :** Construction– working principle – EMF equation – types of DC generators- applications - simple problems.Working Principle of DC motor, types, Torque Equation, Concept of Back EMF- applications - simple Problems.

UNIT – IV Transformers & Induction Machines: Single phase transformer - principle of operation, constructional details, emf equation, losses in transformer, regulation and efficiency, equivalent circuit - simple problems. Three phase Induction Motor: Construction and working principle, slip, rotor frequency, rotor current, and rotor power factor –simple Problems.

UNIT –V Electrical Installations: Components of LT switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Wires and Cables, Earthing. Batteries, Introduction to power converters.

Text Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
3. A. Chakrabarti "Circuit Theory", Dhanapath Roy & Co.

Course Title	ENGINEERING GRAPHICS & DESIGN (Common to ECE & CSE - I SEM) (Common to CE , ME & CSE - II SEM)				B. Tech. ME II Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803207	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		1	0	4	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To Increase ability to communicate with people
- To Learn to sketch and take field dimensions.
- To Learn to take data and transform it into graphic drawings.
- To Learn basic Auto Cad skills.
- To Learn basic engineering drawing formats

To Prepare the student for future Engineering positions

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

CO 1	Use CAD drafting and editing tools along with page templates ,title block & print settings
CO 2	Describe the geometric details of Engineering objects &Become familiar with Auto Cad 2D ,3D drawings
CO 3	Understand Engineering drawing basic theory of projections related to points lines, ,plane and solids in different orientations and drafting them in cad software
CO 4	Analyze various sectional views related to Engineering Drawings and Create isometric drawings with 3d tools along with basic theory& procedures in engineering drawing

UNIT-I

Overview of CAD

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Status Bar, Different methods of zoom as used in CAD, Select and erase objects,copy,move, scaling objects,mirror,rotate,offset,polar array, rectangular Array.

UNIT-II

Customization & CAD Drawing

Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning; Orthographic, constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods , Applying various ways of drawing circles; Annotations, layering & other functions, Diagrams for practice covering drafting and editing commands

UNIT-III

Introduction to Engineering drawing

Principles of Engineering Graphics and their significance, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epi cycloid, Hypocycloid and In volute.

UNIT-IV

Projection of Points, lines, Planes& solids

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes Projections of Regular Solids Projections of solids inclined to both planes. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc

UNIT V

Sections and Sectional Views of Right Angular solids

Sections of Prism, Cylinder, Pyramid and Cone and representation of hatching for various sectional views in cad Development of surfaces of Right Regular Prism, Pyramid, Cylinder and Cone

Isometric & ortho Graphic Projections

Principles of Isometric projection – Isometric Scale, Isometric Views, Orthographic projection and isometric projection techniques with 3d commands, Boolean operations(Union, Region, subtract etc…,)Representation of orthographic projections with viewports, Ucs orientation for representing dimensions for isometric diagrams, scaling

Text Books:

(i) 1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

(ii) Narayana, K.L. & P Kannaiah (2012), 5th Edition, Text book on Engineering Drawing, Scitech Publishers.

(iii) Engineering Drawing + AutoCAD Paperback by K. Venugopal,New age publishers,3rd Edition ,2011

References:

1). Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

2). Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

3). Engineering Drawing with an Introduction to AutoCAD by DhananjayJolhe ,Mc Graw hill

Edition

Course Title	ENGINEERING PHYSICS LAB				B. Tech. ME II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1822208	BSC	L	T	P	C	Internal Eams	End Exams	Total
		0	0	3	1.5	50	50	100
					End Exam Duration: 3Hrs		

Course Objectives:-

- To explore the application of interference and diffraction by doing concerned experiments.
- Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.
- Develop an ability to apply the knowledge of physics experiments in the later studies.
- To understand the concept of energy gap, B-H curve, and synthesis of nano material by performing the experiments**.**

LIST OF EXPERIMENTS

Any 7 of the following experiments has to be performed in a semester:

1. Determination of wavelengths of spectral lines of mercury spectrum using diffraction grating in normal incidence method.
2. Determination of dispersive power of the prism.

3. Rigidity Modulus- Torsonal Pendulum.
4. Study of resonance effect in series and parallel LCR circuit.
5. Determination of thickness of thin object by wedge method.
6. Determination of radius of curvature of lens by Newton's Rings.
7. Laser : Determination of wavelength using diffraction grating.
8. Energy gap of a semiconductor using p-n junction diode.
9. Hysteresis: B-H curve.
10. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method.
11. Frequency of the tuning fork - Melde's apparatus.
12. Spring constant - Coupled Pendulums.

Course Outcomes:

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

1. Evaluate of the application of interference, diffraction phenomena along with laser.(L_5)
2. Support the scientific process in the conduct and reporting of experimental investigations. (L_5)
3. Formulate the measurement technology, usage of new instruments and real time applications in engineering studies. (L_6)
4. Justify the theoretical ideas and concepts covered in lecture by doing hands on in the experiments. (L_5)
5. Develop the characteristics of various materials in a practical manner and gain knowledge about various optical technique methods(L_6).
6. Compose experimental data to examine the physical laws. (L_6)

Lab Manual: Laboratory Manual for Engineering Physics.

Mode of Evaluation: Continuous Internal Evaluation, Practical End Examination.

Course Title	Basic Electrical Engineering Lab				B. Tech. ME II Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Internal Eams**	**End Exams**	**Total**
1802209	**Engineering Sciences (ESC)**	0	0	2	1	50	50	100
						End Exam Duration: 3Hrs		

Course Objectives:-

The objective of the course is to to verify theoretically and practically Kirchhoff's laws, determination of R, L, and C Parameters, measure the power for RL, RC circuits, speed-torque characteristics of DC shunt motor, speed control of 3-F IM, performance of transformer.

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

CO 1	**Understand the Kirchhoff's laws by theoretically and practically.**
CO 2	**Determine the active and reactive power for RL, RC and RLC circuits.**
CO 3	**Determine equivalent circuit parameters on no-load and its performance on load of a 1- Ø transformer.**
CO 4	**Analyze the characteristics of DC shunt motor and 3-Ø Induction motor**
CO 5	**Identify various parts of DC and AC machines, fuse, MCB & Batteries.**

LIST OF EXPERIMENTS

1. Determination of values of R, L and C parameters of a given R-L-C series circuit
2. Verification of KCL and KVL.
3. Determination of Active, reactive and apparent power for R-L circuit (series & parallel).
4. Determination of Active, reactive and apparent power for R-C circuit (series & parallel).
5. Load test on 1-phase transformer.
6. OC & SC tests on 1-phase transformer to obtain equivalent circuit.
7. Torque-speed characteristics of DC shunt motor.
8. Speed Control of three –phase induction motors using pole changing method
9. Demonstration of cut out sections of DC & AC machines
10. Study of fuse, MCB, Batteries

Internal Assessment: Record - 10M, Observation - 15M, Day to Day Assessment - 15M, Viva - 10M, Total Internal Marks - 50M

End Exam: If the question is based on conventional mode: circuit diagram - 10M, connections - 10M, procedure - 10M, result - 10M, viva-10M, total external marks - 50M

Course Title	WORKSHOP AND MANUFACTURING PRACTICES (Common to ECE & CSE - I SEM) (Code 1803110)					B. Tech. ME II Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803111	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		1	0	4	3	30	70	100
Mid Exam Duration: 2Hrs						**End Exam Duration: 3Hrs**		

Course Objectives:

- To understand the basic knowledge of Workshop Practice and Safety.
- To identify and use of different hand tools and other instruments like Hack Saw, Jack Plane, Chisels etc. and operations like Marking, Cutting etc.
- To expose students to different types of manufacturing/fabrication processes
- To develop a skill in dignity of labour, precision, safety at work place, team working and development of right attitude.

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

CO 1	Identify different manufacturing processes which are commonly employed in the industry
CO 2	Analyze the practical knowledge about fabricate components using different materials with their own hands
CO 3	Understand the knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes
CO 4	Understand the knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes

WORKSHOP AND MANUFACTURING PRACTICES:

LIST OF EXPERIMENTS IN THE SYLLABUS

1) MACHINE SHOP: 1.STEP TURNING OPERATION
2.TAPER TURNING OPERATION

2) FITTING SECTION: 1. SQUARE FITTING
2. STEEPED FITTING

3) CARPENTRY SECTION: 1. TEE HALVING JOINT
2. DOVETAIL TEE HALVING JOINT

4).HOUSE WIRING SECTION: 1. TO CONTROL TWO LAMPS BY ONE SINGLE WAY SWITCH(IN SERIES)

2. TO CONTROL TWO LAMPS BY ONE SINGLE WAY SWITCH(PARALLEL)

5. WELDING SECTION: 1. SINGLE V BUTT JOINT

2. LAP JOINT

6. FOUNDRY SECTION: 1. SINGLE PIECE SQUARE PATTERN

2. SINGLE PIECE ROUND PATTERN

7. SHEETMETAL SECTION 1. SQUARE TRY

2. CYLINDER

Textbooks:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., ―Elements of Workshop Technology‖, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

2. Rao P.N., ―Manufacturing Technology‖, Vol. I and Vol. II, Tata McGrawHill House, 2017.

Reference Books:

1. (Kalpakjian S. And Steven S. Schmid, ―Manufacturing Engineering and Technology‖, 4 th edition, Pearson Education India Edition, 2002.

2. Gowri P. Hariharan and A. Suresh Babu,‖Manufacturing Technology – I‖ Pearson Education, 2008.

3. Roy A. Lindberg, ―Processes and Materials of Manufacture‖, 4th edition, Prentice Hall India, 1998.

Course Title	Biology for engineers					B. Tech. ME III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1821301	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	2	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To teach principles of semiconductor Physics
- To introduce electronic devices, including diodes, bipolar junction transistors and FET.
- To understand basic circuits of the electronic devices.
- To learn the biasing of BJT and FET.
- To teach small signal analysis of BJT and FET.

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

CO 1	Define the cells, its structure and function, and Different types of cells and basis for classification of living organisms
CO 2	Explain about biomolecules its structure and function and their role in a living organism.
CO 3	Demonstrate the concept of biology and its uses in combination with different technologies for production of medicines and production of transgenic plants and animals.
CO 4	Illustrate about genes and genetic materials (DNA & RNA) present in living organisms and how they replicate, transfer & preserve vital information in living organisms

UNIT-I

PN Junction Diode: Construction and operation of PN Junction Diode, V-I characteristics, Temperature Dependence, Static and dynamic resistance, Transition and Diffusion capacitance, Zener diode.
Diode Applications: Diode clippers and Clampers, Half wave, Full wave and Bridge Rectifiers with and without filters, Ripple factor and regulation characteristics. Applications of Zener Diode.

UNIT-II

Bipolar Junction Transistors: NPN and PNP Junction Transistors, Current components, CB, CE & CC configurations and their Input & Output Characteristics, Comparison of CE, CB and CC configurations, Saturation, Cutoff and Active regions, α, β and γ parameters and relation between them.
FET: JFET, JFET characteristics and configurations, Pinch off voltage, Drain saturation current,
Parameters of JFET, FET as Voltage Variable Resistor, Comparison between FET and BJT. MOSFET-Depletion and Enhancement types.

UNIT-III

BJT Biasing: Operating point, biasing stability, Various biasing circuits, thermal runaway, stabilization and compensation, Thermal stability, Transistor as an amplifier.
FET Biasing: Fixed bias, Self bias and voltage divider bias.

UNIT-IV

Low frequency Analysis of Transistors: Hybrid model (h-parameters), small signal analysis of a single stage BJT amplifiers, comparison of CE, CB and CC amplifiers, Approximate model analysis, effects of coupling and bypass capacitors on low frequency response.
Small signal models and analysis of JFET and MOSFET. CS, CD and CG Amplifiers and their comparison.

UNIT-V

Special Semiconductor Devices: LED, Photo diode, Photo Transistor, SCR, UJT, Tunnel diode.
Introduction to CMOS: NMOS, PMOS and CMOS-construction, operation, characteristics, advantages and comparison

Text Books:

1. Jacob Millman, Christos C. Halkias, "Integrated electronics" Tata McGraw Hill Publication
2. K. R. Botkar, "Integrated Circuits" 5 th edition, Khanna Publications
3. A. Anand Kumar, "Pulse and Digital Circuits", PHI, 2005.

Reference Books:

1. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.
2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley &Sons, 2006.
4. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.

Course Title	Numerical Methods, Probability and Statistics				B. Tech. ME III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
1823302	PC	3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To teach principles of semiconductor Physics
- To introduce electronic devices, including diodes, bipolar junction transistors and FET.
- To understand basic circuits of the electronic devices.
- To learn the biasing of BJT and FET.
- To teach small signal analysis of BJT and FET.

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

CO 1	Calculate the roots of polynomial and transcendental equations by different methods.
CO 2	Apply discrete and continuous probability distributions
CO 3	Illustrate the components of a classical hypothesis test
CO 4	Infer the statistical inferential methods based on small and large sampling tests.

UNIT-I

PN Junction Diode: Construction and operation of PN Junction Diode, V-I characteristics, Temperature Dependence, Static and dynamic resistance, Transition and Diffusion capacitance, Zener diode.
Diode Applications: Diode clippers and Clampers, Half wave, Full wave and Bridge Rectifiers with and without filters, Ripple factor and regulation characteristics. Applications of Zener Diode.

UNIT-II

Bipolar Junction Transistors: NPN and PNP Junction Transistors, Current components, CB, CE & CC configurations and their Input & Output Characteristics, Comparison of CE, CB and CC configurations, Saturation, Cutoff and Active regions, α, β and γ parameters and relation between them.
FET: JFET, JFET characteristics and configurations, Pinch off voltage, Drain saturation current,
Parameters of JFET, FET as Voltage Variable Resistor, Comparison between FET and BJT. MOSFET-Depletion and Enhancement types.

UNIT-III

BJT Biasing: Operating point, biasing stability, Various biasing circuits, thermal runaway, stabilization and compensation, Thermal stability, Transistor as an amplifier.
FET Biasing: Fixed bias, Self bias and voltage divider bias.

UNIT-IV

Low frequency Analysis of Transistors: Hybrid model (h-parameters), small signal analysis of a single stage BJT amplifiers, comparison of CE, CB and CC amplifiers, Approximate model analysis, effects of coupling and bypass capacitors on low frequency response.
Small signal models and analysis of JFET and MOSFET. CS, CD and CG Amplifiers and their comparison.

UNIT-V

Special Semiconductor Devices: LED, Photo diode, Photo Transistor, SCR, UJT, Tunnel diode.
Introduction to CMOS: NMOS, PMOS and CMOS-construction, operation, characteristics, advantages and comparison

Text Books:

2. Jacob Millman, Christos C. Halkias, "Integrated electronics" Tata McGraw Hill Publication
2. K. R. Botkar, "Integrated Circuits" 5 th edition, Khanna Publications
3. A. Anand Kumar, "Pulse and Digital Circuits", PHI, 2005.

Reference Books:

5. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.
6. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
7. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley &Sons, 2006.
8. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.

Course Title	Engineering Mechanics				B. Tech. ME III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
1801303	PC	3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- The student should understand the some fundamental aspects of Engineering Mechanics.
- To apply and to solve a few basic problems in engineering mechanics like static equilibrium of particles and rigid bodies.
- To Analyze trusses and friction, Properties of surfaces and volumes, Dynamic equilibrium of particles, Dynamic equilibrium of rigid bodies.

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

CO 1	Determine the resultant of system of Forces
CO 2	Identify equilibrium conditions for static problems

CO 3	Describe the centroid of composite figures ,centre of gravity of bodies ,area, moment of inertia and mass moment of inertia
CO 4	Analyse trusses for forces in members

UNIT I

BASIC CONCEPTS: System of Forces– Moment of Forces and its Application– Couples and Resultant of Force System- Equilibrium of system of forces- Free body diagrams –Types of Supports –Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT II

ANALYSIS OF PERFECT FRAMES: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints.

FRICTION: Introduction, Definitions, Types of friction– laws of Solid or Coulomb Friction, Angle of Repose, Equilibrium of a Body lying on a Rough Inclined Plane, Analysis of Ladder Friction.

UNIT III

CENTROID AND CENTER OF GRAVITY: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies

UNIT IV

AREA MOMENT OF INERTIA - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures

MASS MOMENT OF INERTIA: Moment of Inertia of Simple solids, Moment of Inertia of composite masses.(Simple problems only)

UNIT V

Kinematics: Introduction, Velocity, Acceleration, Equations of Motion in a Straight Line under uniform Acceleration, Rectilinear Motion Under Variable Accelerations.

TEXT BOOKS:

1. Dr. R. K. Bansal ,Engineering Mechanics, Laxmi Publications,2005.

2. Fedrinand L.Singer , Engineering Mechanics – B.S. Publishers 2nd Edition.

3. S.S.Bhavikatti ,Engineering Mechanics, New Age International, 2008.

REFERENCES:

1. A.Nelson, Engineering Mechanics-Statics and dynamics, , Tata McGraw-Hill Company, 2009.

2. Timoshenko & Gere, Mechanics of Materials by, CBS, Revised Fourth Edition

3. B. Bhathacharya , Engineering Mechanics - Oxford University Publications, 2014.

Course Title	Manufacturing Process				B. Tech. ME III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1821304	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- The student should understand the some fundamental aspects and design concepts of casting process.
- To familiarize various fabrication techniques used in engineering. To familiarize various types of bulk deformation processes .
- To familiarize about processing of plastic materials.

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

CO 1	Describe the right pattern for an application and proper method of moulding
CO 2	Understand special castings, defects of casting process and to suggest suitable Remedies
CO 3	Apply various special welding techniques and other metal joining processes
CO 4	Select appropriate metal forming techniques to be used for an application

UNIT–I

Casting Process: Casting definition, pattern materials, types of patterns, pattern allowances, color code for patterns, Molding sands, core sands, properties of moldings and its ingredients, different types of molding machines, Elements of gating systems.

UNIT–II

Special Casting Process: CO2 molding, die casting, centrifugal casting, shell molding, investment or lost wax process; Casting defects, causes and remedies. Furnaces used in foundry–cupola, pit furnace, electric arc furnaces.

UNIT- III

Fabrication Process: Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding and MIG welding

UNIT- IV:

Principle and application of special welding processes - Plasma arc welding – Thermit welding – Laser, Electron beam welding – Friction welding – Diffusion welding – Flame cutting – Weld defects – Brazing and soldering process – Types of plastics, properties, applications and their processing methods.

UNIT-V:

Deformation Processes: Hot working –types and cold working of metals-types – Forging processes —Types of Forging Machine and basic operations—Rolling of metals– Types of Rolling mills–-– Principles of Extrusion — Hot and Cold extrusion –Principle of rod and wire drawing . Blanking and piercing- Bending and forming- Drawing and its types- wire drawing and tube drawing- coining and embossing - Hot and cold spinning.

TEXT BOOKS: 1. P N. Rao," Manufacturing Technology", Tata McGraw-Hill Publishing Limited, 5th edition 2019.
2. R.K Jain , Production Technology vol .1 & vol.2 ,KHANNA publishers.
3. P.C. Sharma, "A text book of production technology", S. Chand and Company,

REFERENCE BOOKS: 1. Begman, 'Manufacturing Process", John Wilely & Sons,
2. K.L. Narayana , Production Technology J.K. International Publications.
3. Rajput R.K, 'A text book of Manufacturing Technology', Lakshmi Publications
4. Kalpak jain.S, Manufacturing Engineering and Technology/ 2019,Pearson Education.

Course Title	Strength of materials				B. Tech. ME III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
1803305	PC	3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- The objective of the subject is to learn the fundamentals concepts of stress, strain and deformation of solids with applications to bars and beams.
- The students shall understand the theory of elasticity including strain/displacement and hooks law relationship.
- To accesses stresses and deformation through the mathematical models of beams for bending and bars for twisting or combination of both.
- The knowledge of this subject will help in the design & theory of machines courses

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

CO 1	Explain the stresses , strains ,loads ,beams and provide information required for further design
CO 2	Tabulate the Shear Force and Bending Moment diagrams for beams
CO 3	Apply the bending ,shear stress in beams and longitudinal hoop stresses in thin and thick cylinders
CO 4	Analyze components under complex loading conditions by simplifying

UNIT – I

SIMPLE STRESSES & STRAINS : Elasticity and plasticity – Types of stresses &strains– Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic modulli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

FLEXURAL STRESSES : Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis –Determination bending stresses –section modulus of rectangular and circular sections (Solid and Hollow), I,T,Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV

TORSION OF CIRCULAR SHAFTS- Theory of pure torsion- Derivation of torsion equations; $T/J=q/r=N\theta/l$ – Assumptions made in the theory of pure torsion- torsional moment of resistance- polar section modulus.

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

UNIT – V

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

Thick cylinders lame's equation – cylinders subjected to inside & outside pressures –compound cylinders.

TEXT BOOKS :

1. R.K.Bansal ,Strength of materials ,lakshmi publishers,6th edition 2018
2. S.S.Bhavikatti ,Strength of materials ,lakshmi publications,3rd edition
3. S.S.Rattan ,Strength of materials ,Mc Grawhill companies 3rd edition 2017

REFERENCES :

1. Ramamrutham ,Strength of materials ,Dhanpat rai publications
2. R.K.Rajaput ,Strength of materials ,S.chand &company,6th edition.
3. Dr.Sadhu singh ,Strength of materials ,khanna publishers

Course Title	**Material science and engineering**					**B. Tech. ME III Sem**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803306	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs						**End Exam Duration: 3Hrs**		

Course Objectives:

- To impart knowledge on the structure, The student should understand fundamental properties of materials
- To familiarize of various Heat treatment process & segregation of Steels & Cast irons through Iron-Iron carbide diagram
- Testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

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

CO 1	Describe the relation between structure , properties of metals and non metallic materials
CO 2	Explain the mechanism of crystallization of metals
CO 3	Determine the grain size by using various methods , how it effects on the properties of metals and alloys
CO 4	Analyse the binary phase diagram of iron iron carbon equilibrium diagram. and (TTT) diagram for heat treatment process

UNIT I

CRYSTAL STRUCTURE OF METALS: Introduction to engineering materials and its properties and classifications, Mechanism of crystallization of metals, Recovery Recrystallization and grain growth, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.

CONSTITUTION OF ALLOYS: introduction, Necessity of alloying, types of solid solutions, Hume Ruther's rules, intermediate alloy phases, and electron compounds.

UNIT II

EQUILIBRIUM DIAGRAMS:Construction of equilibrium diagrams, phase rule, Lever rule, Interpretations of phase diagrams, types of phase diagrams, Isomorphous alloy systems, eutectic, peritectic, eutectoid, and peritectoid systems and reactions.

Transformations in the solid state – allotropy, Study of important binary phase diagrams of iron-iron carbon (Fe-Fe_3C) equilibrium diagram, Effect on Alloying elements on (Fe-Fe_3C) system on steels. Relationship between equilibrium diagrams and properties of alloys of Cu-Ni and Al-Cu.

UNIT III

CAST IRON AND STEEL: Introduction to cast iron and steel, classification of cast irons, Structure and properties of White Cast iron, Malleable Cast iron, greycast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steel, structure and properties of plain carbon steel, Low alloy steel, Hadfield manganese steel, tool and die steels.

UNIT IV

HEAT TREATMENT OF ALLOYS: Importanes of Heat treatment of alloys, Heat treatment cycles, Introduction to TTT diagrams,Heat treatment processes: Annealing, normalizing, tempering, Hardening, Hardenability, surface – hardening methods, Age hardening treatment.

POWDER METALLURGY: Production of metal powder condition compaction, sintering and secondary operations, advantages, limitations and applications of powder metallurgy.

UNIT V

NON-FERROUS METALS AND ITS ALLOYS: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys and applications.

Text Books:

1. Donald R.Askel ,Essential of Materials Science and Engineering, , USA, 3rd Edition, Cengage Publisher,2013.
2. V. Raghavan ,Material science, PHI, 5th edition
3. Sidney H. Avner ,Introduction to Physical Metallurgy, US, 2nd Edition, Tata McGraw-Hill, Noida,2007

Reference Books:

1 . R.K.Rajput, Engineering materials and Metallurgy, S chand publishers,2nd edition ,2016
2. William D. Callister ,Materials Science and Engineering, , 8th Edition, 2010
3. Agarwal ,Science of Engineering Materials, TMH.

Course Title	Thermodynamics				B. Tech. ME III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1821307	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To familiarize the concepts of energy in general and heat and work in particular
- To study the fundamentals of quantification and grade of energy
- To study the effect of energy transfer on properties of substances in the form of charts and diagrams
- To familiarize application of the concepts of thermodynamics in vapour power, gas power cycles and lays the foundation for subsequent courses in Fluid Mechanics, Heat Transfer, Energy Systems & Technologies and other thermal engineering Courses such as Turbo machinery, Refrigeration and Air Conditioning, Power Plant Engineering etc.

•	
Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand the concept of system, Control volume,thermodynamic properties ,Thermodynamic Equilibrium, work and heat
CO 2	Determine application of the laws of thermodynamics to wide range of systems
CO 3	Define the properties of the steam by using steam tables and Mollier diagram
CO 4	Analyse various air standard cycles applied in Prime movers

UNIT I

Basic Concepts & Definitions:

Thermodynamics and its importance, Macroscopic and Microscopic view point, Concept of Continuum, Thermodynamic System and its types, Surrounding and Boundary, Control Volume approach and Systems approach, Equilibrium – Thermal, Chemical, Mechanical and Thermodynamic, Pure substance, State, Path, Process and Cycle, Property – Intensive and Extensive, Point Function and Path function, Quasi-Static Process, Reversible and irreversible Processes, Temperature and different scales,Zeroth Law of Thermodynamics.

Heat and Work Transfer:

Work Transfer, Displacement Work, PdV Work in various Quasi-Static Processes, Some Typical Work Forms other than PdV Work, Free Expansion Work, Net Work Done by the System, Heat Transfer, Adiabatic Process, Specific Heat, Latent Heat, Salient Features of Heat and Work Transfer.

UNIT II

First Law of Thermodynamics for a Closed System undergoing a Process, First Law of Thermodynamics for a Cyclic process, Internal Energy – a Property of the System, Enthalpy- a Property of the System, Applications of First Law of Thermodynamics to Non Flow processes, First law of Thermodynamics applied to an Open System like Steam Nozzle, Boiler, Steam Turbine, Pump, Heat Exchanger, Throttling Process, Perpetual Motion Machine of First Kind.

UNIT III

Second Law Of Thermodynamics:

Limitations of First Law of Thermodynamics, Thermal Reservoir – Source and Sink, Concept of Heat Engine, Heat Pump and Refrigerator, Second Law of Thermodynamics - Kelvin Planck and Clausius Statements, Equivalence of Kelvin Planck and Clausius Statements, Reversible and Irreversible Process, Causes of **Irreversibility**, PMM-II, Carnot theorem and its Corollaries, Thermodynamic Temperature Scale.

Entropy:

Clausius Inequality, Clausius Theorem, Concept of Entropy, Entropy – a Property of a System, Isentropic Process, Temperature Entropy plot and its relationship with heat interactions, Principle of increase in Entropy, Change of entropy of typical Processes.

Third Law of Thermodynamics, Absolute entropy

UNIT IV

Properties of Gases and Gas Mixtures:

Ideal Gas, Relation among the specific heats, internal energy, Enthalpy, Analysis of Isochoric, Isobaric, Isothermal, Isentropic, isenthalpic processes, Representation of the above processes on

P-V, T-s Planes, Determination of Work, Heat, Entropy and Enthalpy changes during the above processes

Gas Power Cycles:

Assumptions of Air Standard Cycle, Otto Cycle, Diesel Cycle and Dual Cycle, Comparison of Otto, Diesel and Dual Combustion Cycle, Brayton cycle and Atkinson Cycle

UNIT V

Properties of Pure Substance:

Pure substance, Phase Change Processes of pure substance, Property diagrams for Phase Change Process(T-V, T-S and P-H diagrams), Triple and Critical Points, Properties of Steam, Quality of Steam, Its determination Using Throttling and Separating-Throttling Calorimeters, Steam Processes, Expressions for the change in internal energy, enthalpy, work, heat, entropy in various processes, Mollier Chart

Steam Power Cycle:

Rankine Cycle analysis, Concept of Mean Temperature of Heat Addition, Methods to improve the cycle performance- Regeneration- Reheating

Text Books:

1. P.K. Nag, Engineering Thermodynamics, Sixth Edition 2017, TMH, New Delhi
2. Claus Borgnakke & Richard E Sonntag, Fundamentals of Thermodynamics, Seventh Edition, Willey Eastern, New Delhi
3. Yunus A. Cengel & Michale A Boles, Thermodynamics: An Engineering Approach, Eighth Edition, McGraw Hill

Reference Books:

1. P. Chattopadhyay, Engineering Thermodynamics,2nd edition, 2016,Oxford University Press India
2. Y.V.C. Rao, Engineering Thermodynamics through Examples, Revised Edition, Universities Press (India) Pvt. Ltd.
3. J.P Holman, Thermodynamics, McGraw Hill & Co

Course Title	Material science, Mechanics of solids Lab				B. Tech. ME III Sem			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803308	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- The student should understand the preparation of materials for the testing
- To familiarize various micro structures of materials are determined
- The student to determine the hardness of materials by using of heat treatment process
- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications

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

CO 1	Justify the metal specimen and trace the microstructure at different magnifications
CO 2	Determine and check the hardness of the given Steel specimen before and after annealing and normalizing operations

CO 3	Develop the behavior of material under tensile load and draw stress strain diagram
CO 4	Analyze hardness test on mild steel , brass and copper

MATERIAL SCIENCE LAB: (ANY FIVE EXPERIMENTS)

1.Preparation and study of the Micro Structure of pure metals like, Cu and Al & stain les steels
2.Preparation and study of the Microstructure of low carbon steels, medium Carbon Steels &high Carbon steels.
3.Study of the Micro Structures of white, malleable and grey Cast Irons
4.Study of the Micro Structures of Non-Ferrous alloys.
5.Study of the Micro structures of Heat treated steels.
6.Hardeneability of steels by Jiminy End Quench Test
7.To find out the hardness of various treated and untreated steels.

MECHNICS OF SOLIDS LAB: (ANY FIVE EXPERIMENTS)
1. Tensile strength test
2. Bending test 3. Torsion test 4. Brinell hardness test
5. Test on springs 6. Compression test on cube 7. Impact test
8. Punch shear test

Course Title	**Manufacturing technology Lab**					**B. Tech. ME III Sem**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803309	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	0	0	3	30	70	100
Mid Exam Duration: 2Hrs						**End Exam Duration: 3Hrs**		

Course Objectives:

- The student should understand the some fundamental aspects and design concepts of manufacturing
  pattern and pattern makings for the casting process,
- To determine the sand strengths and permeability of a sand materials and moisture percentages of
  green sand.
- To Know techniques adopted in welding processes like arc, gas, spot, plasma and brazing processes and
  also deep drawing process for making a small size parts with the help of blanking, piercing operations
- To make extrusion operations, bending and processing of plastics like injection molding and blow molding. The student should be prepared to continue the study and analysis of the production machine parts.

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

CO 1	Examine a pattern with allowances
CO 2	Test the properties of the moulding sand and prepare a casting
CO 3	Develop a model using arc welding ,spot welding and soldering

I. Metal Casting lab:

1. Pattern Design and Making : Single piece pattern and Split pattern
2. Sand Properties Testing : Exercise-Strength and Permeability.
3. Casting

II. II. WELDING LAB

1. Arc Welding (Lap joint, Butt Joint & T- Joint)
2. Spot welding
3. Soldering of thin sheets

III. MECHANICAL PRESS WORKING

1. Hydraulic Press
2. Pipe Bending.

IV. PROCESSING OF PLASTICS

1. Injection Molding
2. Blow Molding .

Course Title	APPLIED THERMODYNAMICS				B. Tech. ME IV Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803401	**PC**	**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 develop the student's ability to apply the principles of thermodynamics to predict the performance of the basic energy conversion systems like I.C Engines, air compressors, Boilers, Steam Nozzles, Steam condensers and Steam Turbines
- . To develop the student's ability to use the property tables and charts for the analysis of energy conversion systems in the course of their operation

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

CO 1	Understand the concept and working of I.C Engines, Steam Turbines and Steam condensers etc
CO 2	Describe the operation of air compressors, Steam Generators, Steam Turbines and Steam condensers.
CO 3	Apply thermodynamics laws in engineering applications like IC Engines, Air Compressors, Steam Nozzles etc
CO 4	Evaluate the performance of IC Engines, Air Compressors, Steam Nozzles and Steam turbines etc.

UNIT – I

I.C. ENGINES: Definition of Heat Engine, I.C Engine Classification – Parts of I.C.Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C.Engines SI & CI Engines,
Valve and Port Timing Diagrams, Cooling & Lubrication Systems, Ignition
System-Battery Ignition System, Magneto Ignition system, Brake Power , Frictional Power , Indicated Power and Related efficiencies.

UNIT – II

Air Compressors : Reciprocating Compressors- Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors. Rotary Compressors- Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow compressors **(**Problems Related to Reciprocating Compressors only)

UNIT – III

Boilers: Classification based on Working principles & Pressures of operation –Low Pressure & High Pressure .Boilers – Mountings and Accessories – Boiler horse power, equivalent evaporation, efficiency and heat balance.

UNIT – IV

Steam Nozzles: Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit-Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio. Super saturated flow, its effects

Steam Condensers: Requirements of steam condensing plant, rare fraction – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its effects.

UNIT – V

Steam Turbines
Impulse turbine; Mechanical details – Velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency, De-Laval Turbine - its features. -Velocity compounding and pressure compounding, governing of turbine

Reaction Turbine: Mechanical details – principle of operation, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency, governing of turbines.

TEXT BOOKS:
1. V. Ganesan, Internal Combustion Engines - TMH, 4th Edition
2. P.K. Nag , Basic and Applied Thermodynamics, TMH
3. R.Yadav , Thermodynamics and Heat Engines, Central Book Depot

REFERENCES:
1. M.L.Mathur & Mehta, Jain bros,Thermal Engineering-
2. Mathur& Sharma ,IC Engines — DhanpathRai& Sons, 2010
3. Heywood , I.C. Engines fundamentals, McGrawHill, ,2011

Course Title	FLUID MECHANICS				B. Tech. ME IVSem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1803402	**PC**	**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 introduce and explain fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics etc.
- To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
- To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
- To inculcate the importance of fluid flow measurement and its applications in Industries.

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

CO 1	Employ the basic knowledge of fluid properties.
CO 2	Analyze Hydraulic machines by developing mathematical models to study characteristics of various flows.
CO 3	understand the mathematical techniques of practical flow problems.
CO 4	Understand the boundary layer theory and forces on submerged bodies

UNIT I

FLUID STATICS: Dimensions and units, physical properties of fluids –mass density, specific weight, specific gravity, viscosity, surface tension, vapor pressure, compressibility, elasticity and their influence on fluid motion – atmospheric, gauge and vacuum pressure, measurement of pressure – piezometer, U-tube and differential manometers

UNIT II

FLUID KINEMATICS: Introduction – velocity and acceleration - Stream line, path line and streak line - stream tube - classification of flows – equation of continuity for one dimensional flow and three dimensional flow – circulation and vorticity – velocity potential and stream function –flow net.

FLUID DYNAMICS: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT III

PIPE FLOW: Reynold's experiment – types of flow - Darcy Weisbach equation – Hagen Poiseuille equation Minor losses in pipes – pipes in series and pipes in parallel – total energy line hydraulic gradient line

MEASUREMENT OF FLOW: Velocity measurement - Pitot tube, venturi meter, and orifice meter, Flow nozzle, Turbine flow meter

UNIT IV

Boundary Layer Theory: Boundary gap layer – definition – growth over a flat plate – boundary layer thickness – nominal, displacement, momentum and energy thickness – laminar sub layer – Momentum integral equation of boundary layer - separation of boundary layer- methods of controlling the boundary layer

UNIT V

FORCES ON SUBMERGED BODIES: Introduction – types of drag – drag on a sphere – drag on a cylinder – drag on flat plate – drag on airfoil – effect of compressibility on drag – development of lift on circular cylinder – Magnus effect – lift on an airfoil.

Text Books:

1. Modi and Seth, Hydraulics, fluid mechanics including hydraulic machines, Standard Publishers
2.D. S. Kumar, Fluid Mechanics and Fluid Power Engineering, Kotaria& Sons, 7th Edition, 2012
3. R.K. Bansal ,Fluid Mechanics and hydraulic Machines , Laxmi Publications,2018

Reference Books:

1. R.K. Rajput, Fluid Mechanics and Hydraulic Machines, S.Chand,6th Edition,2013
2. D. Rama Durgaiah, Fluid Mechanics and Machinery ,New Age International, 1st Edition
3. Banga& Sharma , Hydraulic Machines , Khanna Publishers, 7th Edition,2007

	KINEMATICS OF MACHINERY							
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803403	**PC**	**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
GEARS:

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. J.J Uicker, G.R.Pennock & J.E. Shigley, Theory of machines and Mechanisms – Oxford publishers.4th Edition, 2015

REFERENCE BOOKS:

1. R.L Norton , Kinematics and dynamics of machinery, Tata McGraw Hill Publishers,2012

2. Sadhu Singh ,Theory of Machines by Pearson (P).

3. A.Ghosh & A.K.Malik ,Theory of Mechanisms and machines – East West Press Pvt. Ltd.

Course Title	**Basics of Electronics Engineering**					**B. Tech. ME IV Sem**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1814404	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	0	3	30	70	100
Mid Exam Duration: 2Hrs						**End Exam Duration: 3Hrs**		

Course Objectives: • To learn the working of various Diodes and its circuits. • To teach Transistors and its applications. • To know the working and applications of CRO	
Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	**CO1: Understand the functionalities of the diodes.**
CO 2	**CO2: Analyze the performance of rectifiers.**
CO 3	**CO3: Use the transistors in various applications.**
CO 4	**CO4: Understand the working of voltmeters and CROs.**

UNIT-I

DIODE AND ITS CHARACTERISTICS: PN Junction diode, Symbol, V-I characteristics, Diode Applications, Rectifiers-Half Wave, Full Wave and Bridge Rectifiers, Zener diode, photo diode, LED.

UNIT-II

BJT: Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN and PNP Transistors, Input- Output Characteristics of BJT- CB, CE and CC Configurations, Relation between I_C, I_B and I_E. Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications-Transistor as an Amplifier, Transistor as a Switch, Single Stage CE Amplifier, Frequency Response of CE Amplifier.

UNIT-III

Junction Field Effect Transistor: Theory and Operation of JFET, Output Characteristics, Transfer Characteristics, Configurations of JFET- CD, CS and CG Configurations, JFET Applications- JFET as an Amplifier, JFET as a Switch, Comparison of BJT and JFET.

UNIT-IV

Oscillators: Concepts of Feedback Amplifier, Necessary conditions for Oscillators, RC phase shift Oscillator, Colpitts Oscillator, Hartley Oscillator and Crystal Oscillator.

UNIT-V

ELECTRONIC INSTRUMENTATION: Electronic Multi meter and Digital Voltmeter, Integrating Volt meter, Successive approximation DVM, Principles of CRT (Cathode Ray Tube), Deflection Sensitivity, Electrostatic and Magnetic Deflection, Applications of CRO -Voltage, Current and Frequency Measurements

TEXT BOOKS:

1. R.L.Boylestad and Louis Nashelsky, "Electronic devices and circuits", 9th Edition, 2006, PHI.

2. S.Salivahanan – "Electronic Devices and Circuits" – TMH

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

REFERENCE BOOKS:

- 1.Millman‟s Electronic Devices and Circuits-J.Millman and C.C.Halkias, Satyabratajit, 2nd Edition, 1998, TMH.
2. Electronic Devices and Circuits-K.Lal Kishore, 2nd Edition, 2005, BSP. 3 3. 3..G.K.Mittal, "Industrial Electronics".

Course Title	INSTRUMENTATION AND CONTROL SYSTEMS				B. Tech. ME IV Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803405	**PC**	**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: D.S Kumar , Mechanical measurement and control Systems,5th revised enlarged edition ,2012

1. Doeblin O. etaI., Measurement systems: Application and design, , TMH 6th edition.
2. Beckwith, Marangoni, Linehard ,Mechanical Measurements , PHI, PE

REFERENCES:

1. B.C.Nakra & K.KChoudhary, Instrumentation, Measurement & Analysis, TMH,2nd edition2004
2. R.K. Jain ,Mechanical and Industrial Measurements , Khanna Publishers.
3. AK. Tayal , Instrumentation & Mechanical Measurements, Galgotia Publ.

Course Title	**Computer Aided Machine Drawing**				**B. Tech. ME IV Sem**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803406	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		1	2	0	2	50	50	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.

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

CO 1	Demonstrate the conventional representations of materials and machine components.
CO 2	Create solid models and sectional views of machine components.
CO 3	Design 3D assemblies into 2D drawings.
CO 4	Create manufacturing drawing with dimensional and geometric tolerances

The following contents are to be done by any 2D software package

Conventional representation of materials and components:

UNIT-1

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.

UNIT-2

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted , double riveted double strap joints.

UNIT-3

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Shaft coupling, bushed pin-type flange coupling, universal coupling, Oldhams' coupling.

The following contents to be done by any 3D software package

UNIT-4

Sectional views

Creating solid models of complex machine parts and create sectional views.

UNIT-5

Assembly drawings: (Any four of the following using solid model software)

Lathe tool post, tool head of shaping machine, tail stock, machine vice, gate valve, carburettor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling,

production drawing:

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare production drawing with dimensional and geometric tolerances.

Text Books:

1. K.L.Narayana, P.Kannaiah ,Machine Drawing ,New age international Publications, sixth Edition 2019
2. Dr.R.K Dahwan ,A Text Book of Machine Drawing ,s.chand Publications,2018
3. N.D.Bhatt ,Machine Drawing , charotar publications 2018

Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2016
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2016.
3. B.Bhattacharya, Machine Drawing, oxford publications 2017.

Course Title	BASIC ELECTRONICS AND FLUID MECHANICS LAB				B. Tech. ME IV Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803407	**PC**	-	-	3	2	50	50	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- The objective of the subject is to learn the fundamentals concepts of study of CRO ,diodes and Rectifiers
- The students shall understand the characteristics of Emitters and Amplifiers
- The Student gain knowledge in the experiments on impact of jet on vanes, calibration of venturimeter and orificemeter
- The student is able to determine friction factor and discharge coefficient.

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

CO 1	CO1: Utilize knowledge of computing CRO, diodes and rectifiers.
CO 2	CO2: Perform experiments on common emitter and amplifier
CO 3	CO3: calibration of venturimeter, Orificemeter and Mouth piece
CO 4	CO4: Employ the basic knowledge of hydraulics and performance parameters of pumps

LIST OF EXPERIMENTS

PART-A

BASIC ELECTRONICS LAB

1. Study of CRO (Measurement of voltage, frequency and phase of periodic signals)
2. V-I Characteristics of PN junction Diode.
3. Half Wave Rectifier with and without capacitive filter.
4. Full Wave Rectifier with and without capacitive filter
5. Input and output characteristics of Common Emitter (CE) configuration.
6. Frequency response of a single stage CE amplifier.

PART-B

FLUID MECHANICS LAB

1. Calibration of Venturimeter
2. Calibration of Orifice meter.
3. Determination of friction factor for a given pipe line.
4. Calibration of mouthpiece/Orifice
5. Impact of jets on Vanes.

L	T	P	C

B.Tech –IV Sem

0	**0**	**1**	**1**

Seminar
(1803408)

Course Outcomes:
At the end of the course:

1. Students will learn to survey the relevant literature such as books, national/international refereed journals and contact Faculty for the selected topic of seminar.
2 Students will be able to use different experimental techniques.
3 Students will learn to write technical reports.
4. Students will develop skills to present and defend their Report in front of audience.

Syllabus Contents: Students can take up small topic in the field of mechanical engineering as seminar Topic.. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc. The Seminar Topic Must present in presence of Concerned Faculty and co students.

Course Title	**Advanced English Communication Skills**	**B. Tech. ME IV Sem**

Course Code	Lab							
	Category	Hours/Week			Credits	Maximum Marks		
1824409	Humanities and social sciences	L	T	P	C	Internal Assessment	External Exams	Total
		--	--	3	2	50	50	100
					End Exam Duration: 3Hrs			

Course Objectives:

- To focus on improving the student's proficiency in English at all levels.
- To train students to use language effectively to participate in group discussions,
- To help them face interviews and sharpen public speaking skills
- To enhance the confidence of the student by exposing him/her to various situations and contexts which he/she would face in his/her career.
- To make students industry-ready.

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

CO 1	**Describe** Speaking and listening skills
CO 2	**Understand** various kinds of reports and present them schematically
CO 3	**Analyze** Behavioural skills
CO 4	**Illustrate** various employability skills required for the employment
CO 5	**Classify** the verbal and non-verbal communication

1. Syllabus:

The following course content is prescribed for the Advanced Communication Skills Lab:

Reading Comprehension -- Reading for facts, guessing meanings from context, speed reading, scanning, skimming for building vocabulary (synonyms and antonyms, one word substitutes, prefixes and suffixes, idioms and phrases.)

Listening Comprehension ---Listening for understanding, so as to respond relevantly and appropriately to people of different backgrounds and dialects in various personal and professional situations.

Technical Report Writing --- Types of formats and styles, subject matter, organization, clarity, coherence and style, data-collection, tools, analysis

Resume' Writing --- Structure, format and style, planning, defining the career, objective, projecting one's strengths, and skills, creative self marketing, cover letter

Group Discussion--- Communicating views and opinions, discussing, intervening. Providing solutions on any given topic across a cross-section of individuals, (keeping an eye on modulation of voice, clarity, body language, relevance, fluency and coherence) in personal and professional lives.

Interview Skills --- Concept and process, pre-interview plannig, mannerisms, body language, organizing, answering strategies, interview through tele and video-conferencing.

Technical Presentations (Oral) --- Collection of data, planning, preparation, type, style and format, use of props, attracting audience, voice modulation, clarity, body language, asking queries.

2. Minimum Requirements

The English Language Lab shall have two parts:

The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self-study by learners.

The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a TV, A digital stereo-audio and video system, Camcorder etc.

System Requirement (Hardware Component):

Computer network with LAN with a minimum of 60 multimedia systems with the following specifications:

P-IV Processor, Speed-2.8 GHz, RAM_512 MB minimum, Hard Disk-80 GB, Headphones

Prescribed Software: Walden and K-Van Solutions.

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book wich are loaded on the systems):

1. **Technical writing and professional communication, Huckin and Olsen** Tata Mc Graw-Hil 2009.
2. **Speaking about Science,** A Manual for Creating Clear Presentations **by Scott Morgan and Barrett Whitener, Cambridge University press, 2006**.
3. **Handbook for Technical Writing** by David A McMurrey & Joanne Buckely CENGAGE Learomg 2008.
4. **Technical Communication**by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
5. **The ACE of Soft Skills** by Gopal Ramesh and Mahadevan Ramesh, Pearson Education, 2010.
6. **Cambridge English for Job-Hunting** by Colm Downes, Cambridge Unicversity Press, 2008.
7. **Resume's and Interviews** by M. Ashraf Rizvi, Tata Mc Graw-Hill, 2008.
8. **From Campus To Corporate** by KK Ramachandran and KK Karthick, Macmillan Publishers India Ltd, 2010.
9. **English Language Communication: A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.
10. **Managing Soft Skills** by K R Lakshminarayan and T. Muruguvel, Sci-Tech Publications, 2010.
11. **Business Communication** by John X Wang, CRC Press, Spepcial Indian Edition, 2008.

Course Title	ENVIRONMENTAL SCIENCE (CE, ME,EEE-IV SEM)				B. Tech. ME IVSem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
18994M1	**PC**	2	-	0	0	30		30
Mid Exam Duration: 2Hrs						**End Exam Duration: 3Hrs**		

Course Objectives:

- To make the students to get awareness on importance of environment in our life.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

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

CO 1	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.
CO 2	Understand the interconnection of human dependence on this ecosystem.
CO 3	Influence their society in proper utilization of Natural resources.
CO 4	Increases critical thinking and helps in analyzing the impact of developmental activities on environment
CO 5	Learn the management of environmental hazards and disasters and have a clear understanding on environmental concerns and follow sustainable developmental

UNIT I: Introduction to Environmental Studies- Natural Resources (10 lectures)

Multidisciplinary nature of environmental studies. Scope and Importance.

Natural resources and associated problems – Renewable and non renewable Resources

(a) Forest resources –Deforestation: Causes and impacts due to mining, dams – benefits and problems

(b) Water resources – Use and over utilization of surface and ground water – Floods, drought, and conflicts over water

(c) Energy resources –Renewable and Non Renewable energy resources, use of alternate energy resource

(d) Land resources -Soil erosion and desertification, Land degradation.

Role of an individual in conservation of natural resources.

Learning Outcomes: At the end of this unit, student will be able to

*to understand the multidisciplinary nature of the environment

*understand the importance of natural resources

*analyze the problems associated with excess usages of natural resources

*understand role of individual in protection of environment

UNIT II: ECOSYSTEMS (6 lectures)

Ecosystem- Definition–Structure and function of an ecosystem– Energy flow in the ecosystem –Food chains, food webs, Ecological succession.

Introduction, types, characteristic features of the following ecosystem:

(a)Forest ecosystem,(b)Grassland ecosystem,(c)Desert ecosystem,(d)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Learning Outcomes: At the end of this unit, student will be able to

*articulate the basic structure and functions of ecosystem

*provides knowledge on interrelationship of one organism with other organism

*get awareness on different types of ecosystems present in our surroundings and their importance.

UNIT III: BIODIVERSITY AND ITS CONSERVATION (8 lectures)

Levels of Biodiversity: genetic, species and ecosystem diversity – Bio-geographical classification of India – Hotspots .Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – India as a mega-diversity nation – Endangered and endemic species. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes: At the end of this unit,student will be able to

* explains the concept of genetic diversity

*explain endangered and endemic species of India.
* identify the threats to biodiversity due to human involvement
*Provides knowledge on conservation of biodiversity.

UNIT IV: ENVIRONMENTAL POLLUTION (8 lectures)

Definition, Cause, effects and control measures of (a) Air Pollution,(b)Water pollution,(c)Soil pollution (d)Noise pollution. Nuclear hazards –Risks to human health .Solid waste management: Control measures of urban and industrial wastes. Pollution case studies.Global Warming, Ozone layer depletion, acid rains and impacts on human communities and environment.Disaster management: floods, earthquakes, cyclones

Learning Outcomes: At the end of this unit student will be able to

* understand Cause, effects and control measures of air pollution.
* understand soil, noise & water pollution.
*get awareness on impact of global warming and acid rains on humans and environment.
*get knowledge on management of solid waste.

*explain disaster management cycle in India.

UNIT V:

Environmental policies (5 lectures)

Environment Protection Act – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act .International agreements: Montreal and Kyoto protocols and conservation on Biological Diversity (CBD).

Human communities and Environment (5lectures)

Human population and growth: impacts on environment, human health and welfares.

Environmental movements: Chipko, silent valley.

Environmental Ethics: Role of individual in environmental conservation. Public awareness.

Learning Outcomes: At the end of this unit student will be able to

* explain the enforcement of Environmental legislation
*get awareness on punishments associated with destruction of environment

*Understand the impact of growing population on welfare of society

*get knowledge on how to increase public awareness on protection of environment.

FIELD WORK: Visit to a local area to document environmental assets River/forestgrassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds – Study of simple ecosystems-pond, river, hill slopes, etc..

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission, Universities Press.
2. Environmental studies by Benny Joseph, Mc, Graw Hill Publications.
3. Principles and a basic course of Environmental science for under graduate course by Kousic,KouShic.
4. Text book of Environmental science and Technology by M. AnjiReddy,BS Publication.

Reference Books:

1. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
2. Environmental Studies by AninditaBasak – Pearson education.

3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

Course Title	HEAT TRANSFER				B. Tech. ME V Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803501	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

1. To enable the students to understand the fundamental principles and concepts of heat transfer.
2. This course provides the knowledge to understand the various modes of heat transfer like conduction, convection and radiation and also heat exchangers, fins efficiency.
3. To develop methodologies for solving a wide variety of practical engineering problems, and to provide useful information concerning the performance and design of particular systems and processes
4. To gain experience in designing experiments for thermal systems, the design, fabrication, and experimentation of a thin film heat flux gage will be attempted as part of laboratory requirements.

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

CO 1	Formulate and analyze heat transfer system mathematically by conduction mode
CO 2	Apply the conduction heat transfer knowledge on fins which are used in various applications
CO 3	Apply the knowledge of fluid flow and convection heat transfer to analyze the thermal system
CO 4	perform thermal design of various heat exchangers

UNIT I Introduction:

Modes, mechanisms and laws of heat transfer – Relationship between thermodynamics and heat transfer. Conduction Heat transfer: Fourier law of equation – General heat conduction equation in Cartesian, Cylindrical and spherical coordinates. One Dimensional steady state heat conduction in Homogeneous slab, hollow cylinders and spheres – Overall heat transfer coefficient – electrical analogy –with variable thermal conductivity– Composite systems and Logarithmic mean area and geometrical mean area - Critical radius / thickness of insulation - with internal heat sources or heat generation.

UNIT-II One Dimensional Transient heat conduction: Systems with negligible internal resistance - Significance of Biot and Fourier Numbers – Chart solution of transient conduction systems –semi – infinite body and problems. Heat transfer through extended surfaces (or) fins: Extended surface (fins) heat transfer – Long Fin, Fin with insulated tip and short fin with problems

UNIT – III Radiation heat transfer: Introduction, physical mechanism, radiation properties, Concept of black body ,grey body - laws of black body radiation – irradiation - laws of Planck's, wien, kirchoff, Lambert

and Stefan Bolt man law - concept of shape factor- Emissivity – Heat exchange between grey bodies – radiation shields – problems.

UNIT –IV Convection heat transfer: Introduction of convective heat transfer, Concepts of Continuity, Momentum and Energy equation – Classification of convection.

Forced convention:

External flows: Concepts of hydrodynamic and thermal boundary layer and use of empirical correlation for convective heat transfer for flow over – Flat plates, Cylinders and spheres.

Internal flows: Division of internal flow through concepts of Hydrodynamic and thermal entry lengths – use of empirical correlations for convective heat transfer in Horizontal pipe flow, annular flow. Free **Convection:** Development of Hydrodynamic and thermal boundary layer along a vertical plate – convective heat transfer on vertical plates and cylinders.

UNIT – V Heat Exchangers: Introduction, classification of heat exchangers – overall heat transfer coefficient and fouling factor, concepts of LMTD, Effectiveness and NTU method- problems.

Boiling and Condensation: Principles of Boiling-Pool boiling, Regimes and determination of heat transfer coefficient in nucleate boiling, Critical heat flux and film boiling. Condensation - film wise and drop wise condensation- Nusselt's theory of condensation on a vertical plate. Introduction to mass transfer

TEXT BOOKS

1. Basics of Heat and Mass Transfer-D.S.Kumar, Katsons books
2. Holman.J.P, "Heat Transfer", Tata McGraw-Hill, 2008.
3. Ozisik.M.N, "Heat Transfer", McGraw-Hill Book Co., 2003.
4. Kothandaraman.C.P, Subramanyan.S, "Heat and Mass Transfer ", New age International, 7th edition, 2010 .

REFERENCES

1. Fundamentals of Engg.Heat and Mass Transfer – R.C. Sachdeva, 3/E New age International,2009
2. Nag.P.K, "Heat Transfer", Tata McGraw-Hill, New Delhi, 2006.
3. Heat and Mass transfer, R.K. Rajput, S.Chand & Company Ltd.,

DATA BOOK

1. Heat and Mass Transfer – Domkondwar
2. Khurmi.R.S, "Steam Tables", S. Chand Publishers, 2012.

course Title	Design of Machine Elements-I				B. Tech. ME V Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803502	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

1. To study the basic design principles and apply the principles to the design of various elements encountered in Mechanical machines and structures.
2. To determine the strength of the components.
3. To determine the failure conditions and apply them to real life Problems.
4. To design simple joints

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

CO 1	Understand the concepts of design and perform stress analysis on members.
CO 2	Design members Under the action of Fluctuating forces based on failures of theories.
CO 3	Analyze members having welded and rivited joints.
CO 4	Apply Design Procedure for cotter joints ,shaft ,Keys and couplings.

UNIT – I

INTRODUCTION: **General considerations of design, design process. Engineering Materials - properties**

STRESSES IN MACHINE MEMBERS: **Simple stresses – Combined stresses –Torsional and bending Stresses – impact stresses – stress -strain relation-Principal stresses.**

Mechanical behavior of metals.

UNIT – II

THEORIES OF FAILURE **– Factor of safety – Design for strength and rigidity. Concept of stiffness in tension, bending, torsion and Combined cases**

STRENGTH OF MACHINE ELEMENTS: **Stress concentration –notch sensitivity –Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Gerber curve- Goodman's line – Soderberg's line. Modified goodmen method and its applications.**

UNIT – III

WELDED JOINTS**: Introduction-types of welded joints- strength of transverse fillet and parallel fillet welded joints-Axially loaded unsymmetrical welded joints-Eccentrically loaded welded joints.**

RIVITED JOINTS – Elementary treatment for riveted joints

Bolted joints: Forms of screw threads **,** stresses in screw fasteners, design of bolts with pre stresses, design of joints under Eccentric loading.

UNIT – IV

SHAFTS**: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code.**

UNIT – V

COTTER JOINTS: **Design of Cotter joints: spigot and socket, sleeve and cotter-Knuckle joints.**

KEYS AND COUPLINGS: **Design of Rigid couplings: Muff, Split muff and Flange couplings- Bushed pin type flexible coupling.**

Text Books:

1. Design of Machine Elements, V.B. Bhandari , TMH Publishers, New Delhi, 2nd edition, 2013
2. Machine Design, R.S. Kurmi and J.K. Gupta , S.Chand Publishers, New Delhi
3. Mechanical Engineering Design, JosephE.Shigely,TMH Publishers, New Delhi, 9th edition, 2011

Reference Books:

1. Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17th edition, 20
2. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.
3. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2002
4. Design Data Books by KBalaveera Reddy andMahadevan.K
5. Machine Design, R.K.Jain, Khanna Publishers, New Delhi.

NOTE: **Design data books are permitted in the examinations.**

Course Title	METROLOGY				B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803503	**PC**	**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 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
6. 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 linear and 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 – angle gauges – 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 principle Design of Go and No Go gauges.

UNIT – III

OPTICAL MEASURING INSTRUMENTS: Tool maker's microscope – collimators, optical projector – optical flats and their uses, interferometer.
FLATNESS MEASUREMENT: Measurement of flatness of surfaces – straight edges– surface plates – 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, portable 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
Computer aided inspection

TEXT BOOKS:

1. **Engineering Metrology ,Mahajan, DhanpatRai**
2. **Engineering Metrology, R.K. Jain, Khanna Publ.**
3. **Fundamentals of Dimensional Metrology , Connie Dotson ,4e, Thomson**

REFERENCES:

1. BIS standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
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	DYNAMICS OF MACHINERY				B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1803504	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

1. To introduce the laws of precession.
2. To learn about the working of different types of brakes and dynamometers,
3. To able to design the flywheel for an IC engine,
4. To introduce different types of Governors,
5. To analyze the unbalanced forces acting in rotating and reciprocating system and to know the balancing methods of different mechanical systems.

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

CO 1	Solve the numerical problems on brakes and understand the working of Dynamometers
CO 2	Apply gyroscopic principles on aero planes, ships, four wheel and two wheel vehicles.
CO 3	Understand the basics of Governors and forces acting on various governors.
CO 4	Solve the numerical problems on Balancing of Rotating masses and reciprocating masses.
CO 5	Analyze the response of single degree freedom systems with free and forced vibration, and can evaluate the critical speed of the shaft.

UNIT I : TURNING MOMENT DIAGRAMS AND FLYWHEELS: Turning moment diagrams for IC engine and multi cylinder engine. Crank effort- coefficient of fluctuation of energy, coefficient of fluctuation of speed- Flywheels and their design, flywheels for punching machines.

UNIT II : GOVERNORS: Watt, Porter and Proell governors. Spring loaded governors- Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

UNIT III : BALANCING: Balancing of rotating masses- single and multiple masses- single and different planesBalancing of Reciprocating masses- Primary and secondary balancing of reciprocating masses-graphical methods. Unbalanced forces and couples- V- engine, multi cylinder in line and radial engine for primary and secondary balancing.

UNIT IV :

BRAKES AND DYNAMOMETERS: Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers- absorption and transmission types. General description and methods of operation.

PRECESSION: Gyroscopes, effects of precession motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.

UNIT V :

VIBRATION: Free and forced vibration of single degree of freedom system, Role of damping, Whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method. Torsional vibrations- two and three rotor systems.Two Degrees of freedom

Text Books:

1. Theory of Machines, S.S.Rattan,5 th edition, MGH Publishers
2. Kinematics and Dynamics of Machinery R.L.Norton, Tata McGraw Hill
3. Theory of Machines and Mechanisims by Shigley and co, 4th edition, Oxford International Student Edition.

Reference Books:

1. Theory of Machines, Thomos Bevan, Pearson,
2. Theory of Machines , J.E.Shiegley. McGraw Hill
3. Theory of machines by S.S.Rattan, McGraw Hill

L	T	P	C
3	0	0	3

course Title	AUTOMOBILE ENGINEERING				B. Tech. ME V Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803506	PE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- Know the anatomy of the automobile in general
- Understand the location and importance of each part
- Learn the functioning of the engine and its accessories, gear box, clutch,
- brakes, steering, axles and wheels
- Understand the Suspension, frame, springs and other connections
- Know Emissions, ignition, controls, electrical systems and ventilation

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

CO 1	Identify the different parts of the automobile.
CO 2	Explain the working of various parts like engine, transmission, clutch,brakes
CO 3	Describe how the steering and the suspension systems operate.
CO 4	Understand the environmental implications of automobile emissions
CO 5	Develop a strong base for understanding future developments in the automobile industry

UNIT I:

Types of automobiles, vehicle construction and layouts, chassis, frame and body, vehicleaerodynamics, IC engines-components, function and materials, variable valve timing (VVT).

UNIT II:

Transmission systems, clutch types & construction, gear boxes- manual and automatic gear shiftmechanisms, over drive, transfer box, flywheel, torque converter, propeller shaft, slip joints,universal joints, differential and rear axle, Hotchkiss drive and Torque tube drive.

UNIT III:

Steering geometry and types of steering gear box, power steering, types of front axle, types ofsuspension systems, pneumatic and hydraulic braking systems, antilock braking system (ABS), electronic brake force distribution (EBD) and traction control.

UNIT IV:

Alternative energy sources, natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels inautomobiles, modifications needed, performance, combustion & emission characteristics ofalternative fuels in SI and CI engines, Electric and Hybrid vehicles, application of Fuel Cells

UNIT V:

Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotarydistributor type and common rail direct injection system, transistor-based coil ignition & capacitivedischarge ignition systems, turbo chargers (WGT, VGT), engine emission control by 3-way catalyticconverter system, Emission norms (Euro & BS).

Text books:

1. Kirpal Singh, Automobile Engineering, vol I& II 7th ed.,Standard Publishers, New Delhi,

2. Jain K.K.and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002.

3. S.Srinivasan, Automotive Mechanics, 2nd ed., TATA McGraw Hill, New Delhi

4. Heisler H., Advanced Engine Technology, SAE International Publ., USA,

REFERENCE BOOKS:

1.Automobile engineering, R. k Rajput Lakshmi publications

2. Automobile engineering. K. k. Ramalingam Scitech publications

3.Automobile Engineering by R.B.Gupta,Khanna Publishers

4.Automotive Technology by James D.Helderman,USA

course Title	MECHANICAL BEHAVIOR OF METALS				B. Tech. ME V Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803507	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To impart the knowledge in the fields of strengthening mechanism.
- To understand the creep ,fatigue and failures of metals.
- TO know the properties of creep ,toughness,strength,and fatigue.
- To know the properties of advanced and modern metallic materials.

5.

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

CO 1	To employ the various strengthening mechanism
CO 2	Iilstrate the fatigue properties of metals
CO 3	Describe the creep mechanism
CO 4	Illustrate the fracture and fatigue mechanism

UNIT I

BASIC CONCEPTS OF MATERIAL BEHAVIOR :

Elasticity in metals and polymers– Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – . Griffith's theory,– Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps.

UNIT II

BEHAVIOUR UNDER DYNAMIC LOADS AND DESIGN APPROACHES :

Stress intensity factor and fracture toughness – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law.- Safe life, Stress life, strain-life and fail - safe design approaches -Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT III

SELECTION OF MATERIALS :

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing –

UNIT IV

MODERN METALLIC MATERIALS :

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials. Fabrication of glass by blowing ,flat drawing and rolling

UNIT V

NON METALLIC MATERIALS :

Polymeric materials – Formation of polymer structure – Production techniques of fibers reinforced materials by pultrution , pre preg process, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing and applications.

REFERENCES:

1. Ashby M.F., materials selection in Mechanical Design 2nd Edition, Butter worth 1999.

2. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (34d edition), Butterworth-Heiremann, 1997.

3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.

4. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988

5. Metals Hand book, Vol.10, Failure Analysis and Prevention, (10th Edition), Jaico, 1999.

6. Thomas H. Courtney, Mechanical Behavior of Materials, (2nd edition), McGraw Hill, 2000

course Title	Renewable Energy Technologies				B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803508	**PE**	3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- Explain non-conventional sources of energy.
- Familiarize the principles of photo voltaic and MHD power generation.
- Focuses the concepts of various renewable energy generation methods.
- Outline the utilization of renewable energy sources for domestics and industrial applications.

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

CO 1	Possess the knowledge of various renewable energy sources and their utilization
CO 2	Understand the solar PV, wind and MHD power generation systems
CO 3	Familiar with the operations of ocean, geothermal, bio-mass, battery and fuel cell energy conversion systems
CO 4	Compare different energy conversion systems.
CO 5	Apply pollution preventive measures in various energy conversion systems.

UNIT I

Introduction to sources of renewable energy and its overview and importance.

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

UNIT II **MHD and Wind energy:** Principles of MHD Power generation, ideal MHD generator performance, practical MHD generator, MHD technology.

Wind Energy conversion, power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

UNIT III **Tidal energy Wave energy:** Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.

Wave energy conversion, properties of waves and power content, vertex motion of waves, device applications. Types of ocean thermal energy conversion systems, applications of OTEC systems .

UNIT IV **Miscellaneous energy conversion systems:** coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, Co-generation, combined cycle co-generation, energy storage.

UNIT V **Fuel cells:** Types of fuel cells, H2-O2 fuel cells, Application of fuel cells – Batteries, Description of Batteries, Battery application for large power. Environmental effects of energy conversion systems, pollution from coal and preventive measures, steam stations and pollution, pollution free energy systems.

TEXTBOOKS:

1. Wengenmayr, R. and Bührke, T. (2011), Renewable energy: Sustainable energy concepts for the future, John Wiley & Sons.
2. John Twidell & Tony Weir, Renewable Energy Resources, CRC Press , CRC (2015).
3. G.D. Rai, Non conventional Energy sources, Khanna Publishers.

Course Title	SUPPLY CHAIN MANAGEMENT				B. Tech. ME V Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803509	PE	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 able to

- Understand fundamental supply chain management concepts.
- Impart knowledge and understanding to students on Supply Chain Management and its relevance to today's business decision making
- Gain knowledge to evaluate and manage an effective supply chain.

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

CO 1	Understand the Concepts of supply chain , which are aligned with business models for manufacturing and service companiesand warehousing.
CO 2	Determine the decision support system requirements for supply chain management.
CO 3	Design implementation processes for partnerships, such as vendor managed inventory, that involve information sharing and shared governance of processes and infrastructure.
CO4	Evaluate strategic alliances for logistics and retailer-supplier relationships, such as vendor managed inventory.

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UNIT I:

Supply Chain definition – Objectives – Types – Various definitions – Drivers – Need for SCM – SCM as a profession – SCM decisions and skills – Strategy formulation in SCM – Value in Supply Chain – Tradeoffs – CRM Strategy relationship matrix

UNIT II:

Strategic Sourcing – Source evaluation – collaborative perspective – BuyerSupplier Relationship – Partner Selection – develop of Partnership – importance of inventory – imbalances – uncertainties – inventory costs – inventory turnover ration

UNIT III:

Transportation Selection – Tradeoff – modes of transportation – models for transportation and distribution – factors affecting network effectiveness – 3 PL advantages – Indian transport infrastructure – IT solutions – EDI, e-Commerce, eProcurement – Bar Coding and RFID technology

UNIT IV:

Critical business processes and information systems – DBMS – benefits of ERP –information system and bull whip effect – SCM software packages – modeling concepts – Vendor analysis model – Coordinated SCM – Simulation modeling- Reverse Vs forward supply chain – types of reverse flows – collaborative SCM's andCPFR – agile systems – sources of variability – characteristics – supplier interface – internal processes

Unit V:

Supply Chain Management and profitability – quality management – mass customization and globalization – ethical Supply Chains – e-business and SCM – Balanced Score Card – Benchmarking, Performance measurement

Text Books:

1.Mohanty R.P, S.G Deshmuki "Supply Chain Management" Biztantra, New Delhi

2.Sunil Chopra, Peter Meindl, Dharam Vir Kalra " supply Chain Management, Strategy, Planning, Operation" Sixth Edition, Pearson Publications

Course Title	Manufacturing Methods in Precision Engineering				B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803510	**PE**	3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To understand the concepts of precision engineering.
- To obtain knowledge in micro and nano engineering
- To understand various manufacturing methods in precision engineering
- To understand various technologies and processes to applications.
- The course related topics in precision, micro and nano manufacturing,

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

CO 1	Develop and present a conceptual design solution to a precision machine operating in the micro and nano range.
CO 2	Use simulation modeling software to design and analysis a precision mechanical system.
CO 3	Identify and understand the various stages involved in IC manufacture, and be familiar with the main process performance indicators.
CO 4	Calculate Power requirements and process performance in laser cutting.

UNIT – I

INTRODUCTION TO MANUFACTURING AND PRECISION ENGINEERING

Introduction to precision engineering and manufacturing process, conventional and unconventional machining process, micromachining, precision machining and finishing operations. Methods of measurements: during machining and during assembly.

UNIT – II

CONCEPTS OF ACCURACY: Introduction - concept of accuracy of machine tools - spindle and displacement accuracies, Errors due to numerical interpolation - Displacement measurement system and velocity lags.

UNIT – III

PRECISION MEASURING SYSTEMS: Units of length - legal basis for length measurement – Traceability - Processing system of nanometer,
accuracies - LASER light source - LASER interferometer - LASER alignment telescope - LASER micrometer-on-line and in-process measurements of diameter and surface roughness using LASER - Micro holes and topography measurements -.- In processing or insitu measurement of position of processing point-Post process and on-machine measurement of dimensional features and surface mechanical and optical measuring systems.- Straightness and flatness measurement

UNIT IV

MICROMACHINING: Electro Discharge Machining process: General principle and applications of electric discharge machining, electric discharge grinding and electric discharge wire cutting processes – power circuits for EDM, mechanics of metal removal in EDM, process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection - Wire EDM, principle, applications

UNIT – V

NANO POSITIONING SYSTEMS OF NANO ACCURACY & REPEATIBILITY:

Guide systems for moving elements - Servo control systems for tool positioning - Computer Aided digital and ultra precision position control.

TEXT BOOKS:

1. M. V. Suryaprakash ,"Precision Engineering" Narosa publications.
2. V C Venkatesh ," Precision Engineering "McGraw HILL Publications
3. Hiromu Nakazawa" Principles of precision engineering" Oxford University Press

Refrences

1. Kluwer, "A new direction in manufacturing", Academic Publishers, London, 1997
2. Kalpakjian, "Manufacturing engineering & technology", Addison – Wesley, 2nd Edition
3. Debitson A., "Hand book of precision engineering"
4. J. A. McGeough, "Advanced methods of machining", Chapman and Hall, London, 1988
5. Jain V. K., "Introduction to micromachining", Narosa Publishers
6. M. Madou, "Fundamentals of microfabrication"
7. Momber A. W. and Kovacevic R., "Principles of water jet machining", Springer – Verlag
8. R. L. Murthy., "Precision engineering manufacturing", New Age International
9. G. Chryssolouris, "Laser machining – theory and practice", Springer Verlag, New York, 1991

course Title	DESIGN OF MANUFACTURING				B. Tech. ME V Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803511	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To educate students on factors to be considered in designing parts and components with focus on manufacturability.
- To expose the students to dimensional tolerances, geometric tolerances and true position tolerance techniques inmanufacture.
- To impart the knowledge on design considerations for designing components produced using various machining operations like turning, drilling, milling, grindingetc.
- To educate the students on design rules and recommendations for processes like casting, welding, forgings powder metallurgy and injection moulding.

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

CO 1	Select proper materials and manufacturing processes for designing products/components by applying the relevant principles for ease and economic production.
CO 2	Identify faulty design factors leading to increased costs in producing mechanical components.
CO 3	Apply appropriate design tolerances – dimensional, geometric and true position tolerances for the production processes of mechanical components.
CO 4	Apply the concepts related to reducing machined areas, simplification by amalgamation and separation, clampability, accessibility etc., in the design of mechanical components.
CO 5	Analyse the design of castings, weldments, forgings, powder metallurgy components and suggest designmodifications to reduce the cost.

UNIT-1

Introduction: Definition, need for DFM, DFM approach for cost reduction, general design guide lines of DFM, advantages and disadvantages, application of DFM in industries, Design for Quality Manufacturability, DFQM approach, designing for economical production. Design for Excellence (DFX).

Engineering Tolerancing: Basics of dimensional tolerancing, Redundancy, tolerance allocation, Review of relationship between attainable tolerance grades and different machining processes. Geometrical tolerances.

Process capability, mean, variance, skewness, kurtosis, process capability indices- C_p, and C_{pk}. Cumulative effect of tolerance- Sure fit law and truncated normal law,problems.

UNIT-2

True positional theory: Comparison between coordinate and true position method of feature location. True position tolerance- virtual size concept, concepts of datum and changing datum, floating and fixed fasteners, projected tolerance zone and functional gages. Concept of Zero true position tolerance. Simple problems on true positiontolerancing.

Selective Assembly: Interchangeable part manufacture and selective assembly. Deciding the number of groups - model-1: group tolerance of mating parts equal, model- 2: total and group tolerances of shaft equal. Control of axial play- introducing secondary machining operations, and laminated shims; examples.

UNIT-3

Datum Features: Functional datum, datum for manufacturing, changing the datum; examples.

Component Design: Design features to facilitate machining: drills, milling cutters, keyways, Doweling procedures, counter sunk screws, Reduction of machined area, simplification by separation, simplification by amalgamation, Design for machinability, Design for economy, Design for clampability, Design for accessibility. Designing for heat treatment, roller burnishing, and economical de-burring.

UNIT-4

Design of components with casting considerations: Pattern, mould, and parting line. Cored holes and machined holes. Identifying the possible and probable parting lines. Castings requiring special sand cores. Designing to obviate sand cores.

Welding considerations: Advantages of weldments over other design concepts, design requirements and rules, redesign of components for welding; case studies.

UNIT5

Forging considerations -requirements and rules-redesign of components for forging and case studies.

Design of components for powder metallurgy- requirements and rules-casestudies.

Design of components for injection moulding - requirements and rules-casestudies.

Textbooks:

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Designing for Manufacture	Peck H	Pitman Publications	1983
2	Engineering Design: A Materials and processing Approach	Dieter, G.E.	McGraw Hill Co.Ltd	2000
3	Handbook of ProductsDesign for Manufacturing: A Practical Guide to Low-costProduction	Bralla, James G.	McGraw Hill, New York	1986
Reference Books				
1	Engineering Design	Eggert, R.J	Pearson Education, Inc., New Jersey	2005

2	Engineering Design	Matousek , R	Blackie and Son Limited, Glasgow	1967
3	Engineering Design for Manufacture	Kalandar Saheb, S.D and Prabhakar, O.	ISPE	1999
4	Design for Economical Production	Trucks, H.E.	Mich., Dearborn, SME	2nd ed.,1987
5	Processes and Materials of Manufacture	Linberg, Roy A.	Allyn and Bacon, Boston, U.S.A.	4th ed., 1990

Course Title	THERMAL ENGINEERING LAB				B. Tech. ME V Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803513	PCC	3	-	0	1.5	50	50	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

1. To provide knowledge on testing of properties of fuels and lubricating oils
2. To demonstrate and conduct experiments, interpret and analyze data and report results of IC Engine testing
3. To expose the students to the basic knowledge of thermal equipments and help them to develop experimental skills.
4. To study the concepts, applications of the thermal engineering laboratory.

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

CO 1	Compute the property of fuels and lubricating oils using suitable tests.
CO 2	Demonstrate the performance of internal combustion engines and air compressors On successful completion of the courses
CO 3	Interpret the emission characteristics of internal combustion engines.
CO 4	Determine heat transfer enhancement mechanisms, estimate the size and type of heat exchangers.

LIST OF EXPERIMENTS:

1. Valve / Port Timing Diagrams of an I.C. Engines cut models.
2. Optimal cooling water flow rate for an I.C. Engine.
3. Performance Test on 2-Stroke Petrol engine
4. V T D of R.N. engine cut model.
5. Retardation test.
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on 7 H.P. Kirlosker engine
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.
12. Heat balance test on 10 H.P Kirlosker Engine.

Note : Any 10 of the above 12 experiments are to be conducted.

course Title	CAD CAM LAB				B. Tech. ME V Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803514	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	1.5	50	50	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

CO1: Acquire fundamental understanding of the principles of CAD/CAE/CAM, drawing, geometric and surface and feature-based design And Analysis

CO2: Applying CAD/CAM concept to product design and manufacturing

CO3 : Exposure to CAD/CAM software's

CO4: To introduce fundamentals of the analysis software, its features andapplications.

CO5: To know the application of various CNC machines like CNC lathe, CNC Vertical Machining center,

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

CO 1	Develop 2D and 3D models using modeling softwares.
CO 2	Understand CAD/CAM concept to product design and manufacturing
CO 3	Apply CNC control in modern manufacturing system.
CO 4	prepare CNC part programming and perform manufacturing

List of experiments

1.3D Modelling of Given part diagram

2.3D modelling of Flange Coupling

3. 3D Modelling of Piston

4. 3D Modelling & Assembly of cross head

5. Static Structural analysis CAE Software

6.Modal analysis using CAE software

7.Thermal Analysis using CAE Software

8.Step turning

9.Taper turning

10.Thread cutting

11.Linear & Circular interpolation related operations in CNC Mill

12.Drilling and pocketing operations in CNC Mill

Use the following Softwares:

CAD: Autocad,Croe,Catia,Dassault 3D experience,Solidworksetc

CAE: Ansys,Hypermesh,Abaqus solidworks simulations etc

CAM: CNC Train, Master cam, Delcam, Solid cam etc

SUBJECTCODE: ME 1803510	**Additive Manufacturing**	REGULATION:R18	4 – 0 – 0	4 Credits

COURSE OUTCOME(S): At the end of the course, the student shall be acquainted with the knowledge of:

CO1	Importance of AM in Manufacturing
CO2	Different AM Technologies
CO3	Select suitable materials for AM
CO4	Different methods for Post-processing of AM parts
CO5	"Design for manufacture" for AM
C06	Process Analysis
C07	Applications of AM in Automobile, Aerospace, Bio-medical etc.
C08	Future Directions of AM

COURSE OBJECTIVE(S):

1. The main objective of this course is to acquaint students with the concept of AM, various AM technologies, selection of materials for AM, modeling of AM processes, and their applications in various fields.

2. Additive Manufacturing (AM) is an economically viable alternative to conventional manufacturing technologies for producing highly complex parts.

3. The course will also cover AM process plan includingbuilding strategies and post-processing.

SYLLABUS:

UNIT-I

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, **AM process chain**: Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

Classification of AM processes: Liquid polymer system, discrete particle system, molten material systems, and solid sheet system.

UNIT-II

Design for AM: Motivation, DFMA concepts and objectives, AM unique capabilities, Exploring design freedoms, Design tools for AM, Part Orientation, Removal of Supports, Hollowing out parts, Inclusion of

Undercuts and Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly, Identification of markings/ numbers etc.

UNIT-III

Guidelines for process selection: Introduction, selection methods for a part, challenges of selection, example system for preliminary selection, production planning and control ,**AM Applications:** Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development,

UNIT-IV

Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries

Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

UNIT-V

Future Directions of AM: Introduction, new types of products and employment and digiproneurship.

Text Book(s):

1. Ian Gibson, David W. Rosen and Brent Stucker, Additive manufacturingtechnologies: rapid prototyping to direct digital manufacturing, Springer, 2010.

2. C.K. Chua, K.F. Leong and C.S. Lim, Rapid prototyping: Principles andapplications, 3rd Edition, World Scientific, 2010.

Reference(s):

1. Chua Chee Kai, Leong Kah Fai, “Rapid Prototyping: Principles & Applications”, World Scientific, 2003.

2. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010

3. Ali K. Kamrani, Emand Abouel Nasr, “Rapid Prototyping: Theory & Practice”, Springer, 2006.

4. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001

1. Andreas Gebhardt, Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing, Hanser Publishers, 2011.

2. J.D. Majumdar and I. Manna, Laser-assisted fabrication of materials, SpringerSeries in Material Science, 2013.

3. L. Lu, J. Fuh and Y. S. Wong, Laser-induced materials and processes for rapidprototyping, Kluwer Academic Press, 2001.

4. Zhiqiang Fan and Frank Liou, Numerical modeling of the additive manufacturing(AM) processes of titanium alloy, lnTech, 2012.

Course Title	Socially Relevant Projects					B. Tech. V Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803515	PROJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		--	--	-	2	100	--	100
Course Objective: The objective of the project is to enable the student to take up investigative study in rural areas in the field of mechanical Engineering								
On successful completion of this course, the students will be able to								
CO 1	Understand core concepts and research findings relative to human development, socialization, group dynamics and life course processes.							
CO 2	Identify and transfer existing ideas into new contexts and applications							
CO 3	Apply and transfer academic knowledge into the real-world							
CO 4	Design a component or a product applying all the relevant standards and with realistic constraints							

The following are the rules and regulation for Socially Relevant Projects:

1. The student has to spend 50 to 60 Hrs in the semester on any socially relevant project and submit a report for evaluation.
2. The project is evaluated for 100 marks in the semester by a committee consisting of head of the department, project mentor and one senior faculty member of the department.
3. A student shall acquire 2 credits assigned, when he/she secures 50% or more marks from the total of 100 marks.
4. In case, if a student fails, he/she shall resubmit the report.
5. There is no external evaluation for the socially relevant project.

SUGGESTIVE LIST OF PROGRAMMES UNDER SOCIALLY RELAVENT PROJECT :

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Departments are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering V Students

1. Water facilities and drinking water availability

2. Health and hygiene

3. Stress levels and coping mechanisms

4. Health intervention programmes

5. Horticulture 6. Herbal plants

7. Botanical survey

8. Zoological survey

9. Marine products

10. Aqua culture

11. Inland fisheries

12. Animals and species

13. Nutrition

14. Traditional health care methods

15. Food habits

16. Air pollution

17. Water pollution

18. Plantation

19. Soil protection

20. Renewable energy

21. Plant diseases

22. Yoga awareness and practice

23. Health care awareness programmes and their impact

24. Use of chemicals on fruits and vegetables

25. Organic farming

26. Crop rotation

27. Floury culture

28. Access to safe drinking water

29. Geographical survey

30. Geological survey

31. Sericulture

32. Study of species

33. Food adulteration

34. Incidence of Diabetes and other chronic diseases

35. Human genetics

36. Blood groups and blood levels

37. Internet Usage in Villages

38. Android Phone usage by different people

39. Utilization of free electricity to farmers and related issues

40. Gender ration in schooling level

VI sem syllabus R-18)

Course Title	MACHINE TOOLS				B. Tech. MEVI sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803601	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:

Course Objective:

- The objectives of this course are to introduce to demonstrate the fundamentals ofmachining processes and machine tools.
- To develop knowledge and importance of metal cutting parameters, tool materials,cutting fluids and tool wear mechanisms.
- To apply knowledge of basic mathematics to calculate the machining parameters fordifferent machining processes and acquire knowledge on advanced manufacturingprocesses.
- The students will have the knowledge and hands-on experience that willenable them to work in a typical machine shop.

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

CO 1	After completion of this unit students are able to understand the basic concepts of thephilosophy of metal cutting and the mechanism of chip formation understand the basic concepts ofturning.
CO 2	After completion of this unitStudent shall be made familiar with various tooling accessories used in turningand understand different constructions of lathe depending on the nature of operation and basic principle of, shaping and planing operation, parts of the shaping ,slotting and planingmachines and tool holding devices, operations performed on shaping andplaning and machining calculations.
CO 3	After completion of this unit students are able to understand the basic principle ofdrilling and boring operations, parts of the drilling and boringmachine.
CO 4	After completion of this unit students are able to understand the principle of milling,types, parts of the milling machines and operations performed on milling machines..
CO5	After completion of this unit students are able to understand the principle of, grinding, Lapping, Honing and Broaching operation, parts of the grinding machines.

UNIT – I

Basic elements of machining – Orthogonal, Oblique Cutting, Classification of cutting tools. Geometry of Single point cutting tool and Angles, Types of Chips, Chip Breakers. Cutting Tool materials, Tool failures.

ENGINE LATHE: Principle of working, Specification of Lathe, Types of Lathes, Operations performed, Workholding devices, Machining Parameters – Cutting Speed, Feed, Depth of Cut and Machining time, Taper turning methods, Thread cutting,

UNIT – II

Shaper– Working principle, Specifications, Classification, Principle parts of a

Shaper, Machining time Calculations.
Planer - Working principle, Specifications, Classification, Principle parts of a Planer
Slotter- Working principle, Specifications, Classification, Principle parts of a Slotter

UNIT – III

DRILLING MACHINES: - Specifications, Operations performed, tool holding devices, Twist drill, types of drilling machines – Sensitive drilling machine, Upright drilling machine, radial drilling machine, Gang drilling machine, Multiple Spindle drilling machine.
BORING MACHINES: Types – Horizontal Boring machine, Jig Boring machine.

UNIT – IV

Milling machine – Principles of working – specifications – classifications of milling machines – Principle features of horizontal, vertical and universal milling machines –machining operations,– Up milling and Down milling - Working mechanism of Universal Dividing head, methods of indexing –Direct, Plain, Compound, Differential and Angular.

UNIT –V

GRINDING MACHINES: Classification of grinding machines – Cylindrical and Surface grinding machines – Tool and Cutter Grinders. Grinding wheel – Specification, Selection of grinding wheel, Wheel truing and Wheel dressing.
BROACHING :Types of broaching machines – Horizontal, Vertical, Continuous broaching machines, Elements of broach, broaching operations.Introduction to Lapping and Honing.

TEXT BOOKS :

1. Production Technology, R.K. Jain and S.C.Gupta.
2. Workshop Technology – Vol II, B.S. Raghuwanshi.
3. Workshop Technology – Vol II, HazraChoudhary

REFERENCES :

1. Machine Tools, C.Elanhezhian and M. Vijayan, Anuradha Agencies Publishers.
2. Manufacturing Technology, Kalpakzian,Pearson
3. Production Technology, H.M.T. (Hindustan MachineTools).
4. Introduction to Manufacturing Technology, Date, Jaico Publ.House

Course Title	DESIGN OF MACHINE ELEMENTS - II				B. Tech. ME V1 Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803602	**PCC**	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 bearings
3.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 capacityFatigue 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 BOOK:

1. Machine Design ,V.B.Bhandari, TMH25

2. Machine Design, R.S. Khurmi&J.S.Gupta, S.Chand Publ.

REFERENCES:

1. Mech. Engg. Design, JE Shingley

2. Design of Machine Elements-II, T. Krishna Rao, I.K. International

3 Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17th edition, 20

5. Mechanical Engineering Design, JosephE.Shigely,TMH Publishers, New Delhi, 9th edition,

Course Title	OPERATIONS RESEARCH				B. Tech. ME VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803603	**PCC**	3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To understand the concepts of linear programming techniques
- To obtain knowledge in inventory control and queuing theory
- To learn simulation techniques
- To understand various sequencing models and application of this models in
- process planning
- To understand various replacement models in order to make optimum
- replacement decisions

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

CO 1	Understand the concept of OR and its applications.
CO 2	Describe Transportation and assignment models.
CO 3	Apply group replacement and individual replacement techniques to solve problems.
CO 4	Determine simulation, queuing Models
CO5	Evaluate inventory models.

UNIT – I

Introduction to operations Research: Development, Definition, Types of models, Operation Research models and Applications
ALLOCATION: Linear programming problem formulation, Graphical solution, Simplex method, Big-M method and Duality

UNIT – II

TRANSPORTATION PROBLEM: Formulation, Optimal solution, unbalanced transportation problem, Degeneracy.
Assignment problem: Formulation, Difference between assignment and Transportation models, To represent assignment model as transportation model (or) L.P.P. Optimal solution and applications of Assignment Problem .Solution to pure and mixed integer programming problem by Branch and bound and cutting plane algorithms.

UNIT – III

REPLACEMENT: Introduction, Replacement of items that deteriorate with time

when money value is not considered and considered, Replacement of items that fail completely and Group replacement.

SEQUENCING: Introduction, Flow Shop sequencing, n jobs through two machines, n jobs through three machines, n jobs through m machines, Two jobs through m machines, Traveling Salesman problem

UNIT IV

WAITING LINES: Single Channel: Poisson arrivals, Exponential Service times with finite queue length and non finite queue length models
Multichannel: Poisson arrivals, Exponential service times with finite queue length and non finite queue length models.
SIMULATION TECHNIQUES: Monte Carlo simulation techniques. Advantages and disadvantages and Simulation Languages

UNIT – V

INVENTORY:
Introduction, Single item deterministic models, Purchase inventory models with one price break and multiple price breaks
Stochastic models: Demand may be discrete variable or continuous variable, Instantaneous production, Instantaneous demand and continuous demand and no setup cost.

TEXT BOOKS:

1. Operations Research, SD Sharma, kedarnath publications .
2. Introduction to Operations Research, Taha, PHI

REFERENCES:

1. Operations Research: Methods & Problems, Maurice Saseini, Arhur Yaspan & Lawrence Friedman
2. Operations Research, R.Panneerselvam, PHI Publ.
3. Operations Research, J.K. Sharma
4. Operations Research, K.Rajagopal,PHI.

Course Title	POWER PLANT ENGINEERING				B. Tech. MEVI sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803604	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:

Objectives that students will meet at the end of the course:

1. list the sub systems of a plant, indicating the function of each subsystem
2. Sketch typical subsystems of a power plant (example: sketch the coal and ash handling system
3. Perform basic analyses associated with each subsystem
4. Sketch the flow of water-steam, fuel, and air through a plant

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

CO 1	Understand the concept of powerplant engineering and its applications.
CO 2	Know Diesel power plant and gas turbine
CO 3	Analyze Working and performance of various power plants like hydro and nuclear power plants
CO 4	Evaluate different types of non conventional energy sources
CO5	Estimate Power plants economics.

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India

STEAM POWER PLANT: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems, cooling towers and condensers.

UNIT – II

INTERNAL COMBUSTION ENGINE PLANT: DIESEL POWER PLANT: Introduction –IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

GAS TURBINE PLANT: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison

UNIT – III

HYDRO ELECTRIC POWER PLANT: Water power – Hydrological cycle / flow

measurement

– drainage area characteristics – Hydrographs – storage and Pondage –classification of dams and spill ways.

HYDRO PROJECTS AND PLANT: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

NUCLEAR POWER STATION: Nuclear fuel – breeding and fertile materials – Nuclear reactor

– reactor operation.

TYPES OF REACTORS: Pressurized water reactor, boiling water reactor, sodium graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT IV

POWER FROM NON-CONVENTIONAL SOURCES: Utilization of Solar- Collectors-Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy. DIRECT ENERGY CONVERSION: Solar energy, Fuel cells, MHD generation.

UNIT – V

POWER PLANT ECONOMICS AND ENVIRONMENTAL CONSIDERATIONS: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, and load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution contro

TEXT BOOK:

1. Power Plant Engineering, P.K.Nag, 2/e, TMH.
2. Power Plant Engineering, P.C.Sharma , S.K.Kataria Publ
3. A Course in Power Plant Engineering, Arora and S. Domkundwar

REFERENCES :

1. Power plant Engineering, Ramalingam, Scietech Publ.
2. A Text Book of Power Plant Engineering , Rajput. R.K., 4/e, Laxmi Publ,2007.
3. Power Plant Engineering, C. Elanchezian and others, I.K. International, 2010.

Course title	GAS TURBINES AND JET PROPULSION				B. Tech. ME VI Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803605	**PE**	3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

1. To Familiarize with basic components of gas turbine
2. To analyze the power cycles and performance predictions
3. To understand Aircraft propulsion
4. To understand different types of Rocket propulsion systems and performance prediction

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

CO 1	Student can analyze the simple gas turbine cycle in determining the specific work and thermal efficiency. Also, student can able to know the methods in improving them is using combinations of reheating as well as regeneration.
CO 2	Student can able to understand the basic principle of jet propulsion. Also, student can able to know the working of various Pilotless and piloted propulsion devices. Student can understand thrust equations, calculating propulsive power, and propulsion efficiency. Also, student can have knowledge on thrust augmentation methods.
CO 3	Student can analyze the working of ramjet engine thermodynamically. Student can aware the calculations related to efficiency. Student can distinguish the working of Ramjet from Pulsejet and Serquijet engines.
CO 4	Student can able to understand the working of rocket engine. Student can have knowledge on propellants of rocket engines. Student can aware of parameters affecting the parameters of performance. Student can get difference between various domains of application.
Co5	Evaluate the performance of rocket engines

UNIT-I

Gas Turbines: gas turbine applications, gas turbine advantages & disadvantages, Simple open cycle gas turbine, deviation from ideal cycle, gas turbine with regeneration, thermal efficiency of gas turbine with & without regenerator, gas turbine engines with inter cooling & reheating.

UNIT-II

Jet propulsion: Historical sketch- reaction principle- essential features of propulsion devices- thrust; thrust power and propulsion efficiency- need for thermal jet engines and applications.

UNIT-III

Turboprop and turbojet – thermodynamic cycles, plant layout, essential components, and principles of operation – performance evaluation – thrust augmentation and Thrust reversal – contrasting with piston engine propeller plant.

UNIT-IV

Ram jet- Thermo dynamic cycle, plant lay out, essential components – principle of operation – performance evaluation – comparison among atmospheric thermal jet engines-pulse jet- elementary treatment.

UNIT-V

Rocket Engines: Need for, applications- basic principle of operation and parameters of performance – classification, solid and liquid propellant rocket engines, advantages, domains of application – propellants – comparison of propulsion systems ,staging of rockets

TEXT BOOKS:

1. Gas Turbines , V. Ganesan TMH

2. Gas Dynamics & Jet Propulsion, Dr. S.L. Somasundaram.

REFERENCES:

1. Gas turbines, Cohen , Rogers &SarvanaMuttoo , Addision Wiley &longman

2. Thermodynamics of Propulsion, Hill & Paterson.

3. Rocket Propulsion , Sutton.

Course Title	COMPUTER AIDED PROCESS PLANNING				B. Tech. ME VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803606	**PE**	**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:

1.To understand the concept of process planning and various methods of process planning using computer

2. To understand the geometric model of the component in CAD technology of computer graphics in order to describe part features for process planning.

3. To understand the Steps involved in variant type computer aided process planning and generative type computer aided process planning.

4. Understanding the concept of Group technology to implement variant type computer aided process planning.

5. To understand the principle of NC, CNC, Machining Centre and various methods of part programming.

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

CO 1	understand the importance of CAPP and group Technology
CO 2	Analyze the basic concepts of NC and CNC machine tool programming and computer aided part programming
CO 3	knowledge about advanced manufacturing systems like CAPP, Group Technology FMS and CIM.
CO 4	Select the proper cutting tool material and components of jigs and fixtures.
CO5	Evaluate different manufacturing tolerences

Unit I

Introduction to process planning, Information required for process planning system, Steps in process planning, Route sheet, Manual approach, Computer aided process planning: Retrieval CAPP system, Generative CAPP system, Hybrid approach, CAPP applications, Facts about CAPP technology, Criteria for selecting a CAPP system, Benefits of CAPP and Limitations of CAPP

UNIT II

Introduction to group technology, Benefits of group technology, Part family, Methods of grouping the parts into part family: The visual inspection method, Part classification and coding system, MICLASS classification and coding system, Opitz classification system,Production flow analysis , Composite part, Limitations of group technology, Application of group technology in CAPP, Retrieval CAPP system:Principle, Structure of Retrieval CAPP system, Advantages ,Disadvantages, Applications and MIPLAN system

UNIT III

Generative CAPP system: Principle of Generative CAPP system, Essential elements in a generative CAPP system, Implementation of generative CAPP systems,Advantages,DisadvantagesandApplications.
Selection of manufacturing sequence: Identifying machinable volumes or pockets required in machining process, Setup planning, Attaching pockets to setups, Determining holding method, Alternative sequences, Quantitative methods for optimal selection and Computer method for sequencing operations for assembly lines

Unit –IV
Factors affecting selection of manufacturing process, Manufacturing possesses for metals,Machining process, Cutting parameters, Different approaches for solving speed/feed selection problem, Elements of cost in manufacturing operation, Optimization model to predict the optimum speed, Breakeven analysis in selection of process.
Flexible Manufacturing System: Components of FMS, FMS equipment & control, Programmable logic controller, Processes interface programming the PLC, Local area network , Automated guided vehicle systems, Automated storage and retrieval system, Operational problem in FMS.

Computer Integrated Manufacturing (CIM): Elements of CIM, CIM hierarchy, implementation of processes
Unit –V
Determination of manufacturing tolerances: Design tolerances, Manufacturing tolerances,Need of tolerances in design and manufacturing, Tolerance allocation ,Tolerance analysis models for assemblies: Worst case, Statistical, Tolerance allocation methods: Allocation by proportional

scaling, Allocation by constant precision factor, Tolerance allocation using optimization techniques, Automatic tolerance analysis, Advantages of integrated approach over sequential approach

Text Books:

1. Automation, Production systems and Computer Integrated Manufacturing System ,Mikell P.Groover
2. Computer Aided Design and Manufacturing, Dr.Sadhu Singh.
3. Computer Aided Engineering, David Bedworth

Reference Books :

1. Computer integrated Design and Manufacturing – David DBedworth

2. P.N.Rao, Computer Aided Manufacturing, Tata McGraw Hill Publishing

Course Title	CONCURRENT ENGINEERING				B. Tech. ME VI Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803607	PE	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:

1.Student can learn topics of Concurrent engineering and its Goals

2.At the end of course student can learn concurrent Engineering Tools and Techniques

3.Student learn Roles and Responsibilities

4.At the end student can have a knowledge on JIT Systems

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

CO 1	Understand the principles of concurrent engineering and its implementation
CO 2	familiarize with the basics of concurrent engineering
CO 3	Apply tools and methodologies available in CE
CO 4	Analyze various approaches to CE
CO5	Determine the case studies in JIT

UNIT I

Introduction to Concurrent Engineering, Definitions, Historical Background, Goals of CE, Need for CE, Development process with CE Role of CAD/CAM in CE and Product life cycle

UNIT II

Concurrent Engineering Tools & Techniques, Quality function Deployment, Value function analysis, Failure Mode & Effect Analysis, Design for Manufacture & Assembly, Design for X , Taguchi's Robust Design approach ,Pugh process , customer Focused Design , rapid prototyping and simulation.

UNIT III

Implementing CE in an organization, concurrent engineering teams, their roles and responsibilities, Organizational functions to support CE team environment, Setting Team goals, measuring performance of team & managing a CE Team, Limitations of team

UNIT IV

Design for manufacture & Assembly, Design for economics, Design for X, Product Data Management, Agile manufacturing and rapid prototyping& simulation.

UNIT V

Introduction JIT, Design, development & management for JIT , Implementation of JIT, supply product Life cycle management, Project time management , Techniques of time management and Collaborative product commerce simple case studies in CE

TEXT BOOKS:

1. Thomas A. “Concurrent Engineering”, Salomone, Maarcel Dekker Inc.New York, 1995.
2. Moustapha .I “Concurrent Engineering in product Design Development” New Age International (p) Ltd., 2003.

REFERENCE BOOKS:

1. Prasad, “Concurrent Engineering fundamentals - Integrated Product Development”, Prentice Hall, 1996.
2. Sammy G. Sinha, “Successful implementation of concurrent product & process”, Wiley, John &Sons, Inc., 1998.
3. Anderson M.M. & Hein L. Berlin, “Integrated Product Development”, Springer Verlog,

1987.

Course Title	INTRIDUCTION TO ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS.					B. Tech. ME VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803608	**PE**	3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs						**End Exam Duration: 3Hrs**		

Course Objectives:

The student will learn to

- 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	understand the Problem. Space, Predicate Logic, Knowledge Representation using rules.
CO 2	KNOW the Symbolic reasoning under Uncertainty, Statiscal Reasoning
CO 3	study the Slot and Filler Structures, Game Playing, Natural Language processing, Expert system
CO 4	Analyze Weak Slot Filler Structures
CO 5	Evaluate Game Playing

UNIT-I: Introduction to AI: History, 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, Statiscal Reasoning.

UNIT-IV: Weak Slot Filler Structures, Strong Slot and Filler Structures, Knowledge Representation summary.

Unit –V: Game Playing, Natural Language processing, Expert system.

Text Books:

1.Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.

Reference Books:

- Saroj Kaushik. Artificial Intelligence. Cengage Learning, 2011.
- Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004.

Course Title	VIRTUAL REALITY SYSTEMS				B. Tech. ME VI Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803609	PE	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 Objective:

- Design a virtual environment and compelling virtual reality experience.
- Create compelling virtual experiences.
- Comprehend and analyze the fundamental issues of virtual reality.
- Comprehend the IEEE VR proceedings.

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

CO 1	Simulate flight
CO 2	Know Different Hardware and input devices
CO 3	Know Software technologies and 3d interaction techniques
Co4	Design 3D interfaces and virtual reality applications
Co5	Identify different virtual reality applications

UNIT-1

VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS: The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality.

UNIT-2

HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES: Visual Displays Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces. (6) 3D USER INTERFACE INPUT HARDWARE: Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces.

UNIT-3

SOFTWARE TECHNOLOGIES: Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market

UNIT-4

3D INTERACTION TECHNIQUES: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestrual Commands, Tools, Mutimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry

UNIT-5

DESIGNING AND DEVELOPING 3D USER INTERFACES: Strategies for Designing and Developing Guidelines and Evaluation. (2) ADVANCES IN 3D USER INTERFACES: 3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces, Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, Questions of 3D UI Technology, 3D Interaction Techniques, 3D UI Design and Development, 3D UI Evaluation and Other Issues. VIRTUAL REALITY APPLICATIONS: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.

Text Books: 1. Virtual reality systems By John Vince –Pearson's education.

2 Virtual reality technology and applications –Mihelj & etal.,

REFERENCES:

1. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.

2. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.

3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.

4. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.

5. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

6. John Vince, "Virtual Reality Systems", Addison Wesley, 1995.

7. Howard Rheingold, "Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society", Simon and Schuster, 1991.

8. William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 20

Course Title	AUTOTRONICS				B. Tech. ME VI		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803610	PEC	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 learn the basics of electrical and Laws.

1)To study about the electrical safety and importance of earthing.

2).To study the construction and principle of DC Motor and its types.

3).To understand about the generator, alternator, regulator and starting motor and mechanism and the different ignition system and the lead acid battery testing.

4).To learn about the lighting system and its components in the

Course Outcomes: On successful completion of this course

CO 1	Students are able to understand the knowledge on Basic Electrical supply and safety
CO 2	Students will know the principles of working of the battery and ignition systems
CO 3	Students are able to study the different types of generators, alternators, regulators & starting motor
CO 4	Students are able to understand various Lighting,Lamp,Horn,Gauge &Wiring and basic electronics & Computer applications in automobile.
CO 5	Students are able to analyze different sensors used in automobiles

Unit-1

BASIC ELECTRICITY & MAGNETISM

Definitions – charge, current, electromotive force, voltage, potential difference, inductance and capacitance. Explanations of electricity, properties of conductors, insulators and semiconductors, conventional theory of current flow & electron theory of current flow,

Kirchoff's law & Ohm's law, resistance & resistivity of conductors, pulsating & pure direct currents, sinusoidal & non- sinusoidal alternating currents, peak average, RMS value of AC, frequency, wavelength, amplitude, time period, single phase & three phase AC power & power factor.

Explanations of parallel(shunt) & series circuits involving source & loads, open & short circuits, importance of earthing on chassis in automotive wiring,

Magnetism, magnetic flux density, magnetic field intensity, electromagnetic induction, Flemings' left hand & right hand rules, electromagnetic permeability, electromagnetic reluctance, application of electromagnetism in an automobile.

Unit-2

BATTERY & IGNITION SYSTEMS

Automobile electrical systems- generator, storage & distribution systems, starting system, ignition system, lighting system & accessories.

Battery- lead acid battery- construction & working, battery rating, battery testing and battery charging methods.

Requirements of ignition system, types of ignition system in engine, principles of working battery coil ignition with mechanical distributor, CB point controlled magneto ignition system, Electronic battery coil ignition systems & magneto ignition system through electrical circuit diagrams, difference between battery coil & magneto coil ignition systems

Spark plug – types, characteristics & materials, importance of ignition timing, setting ignition timing, needs & types of advance mechanism- centrifuge – vacuum advance mechanism.

Unit-3

ELECTRICAL MACHINES (GENERATORS, ALTERNATOR, REGULATOR & STARTING MOTOR)

Generator – Purposes – Construction – Field winding – Armature winding – Commutator – Brushes – Brush gears – Testing – Field winding – Armature –Growler testing – Brush – spring tension – Under cutting – Skimming commutator – Brush bedding.

Alternator – Purpose – Construction – Body – Stator winding, Rotor winding, Slip rings – Brush - Advantages of alternator – trouble shooting in the alternator and armature.

Regulator: Need for the regulator, Cut out or reverse cut out relay, Constant current and voltage regulator – compensated voltage regulator

– trouble shooting in regulator – dynamo – principle.

Starting motor – Need – Working Principle – Construction – Body – Field coil – Armature windings – Poles – Commutator and brush gears – Solenoid switch. Starting motor drive mechanism – Bendix – Over running clutch type drive & coaxial drive mechanism in the heavy vehicles – complete electrical circuits of heavy duty starting motor – First contact and second contact closing – Troubles – Causes & remedies –

Electric Starting circuits in two wheelers.

Unit-4

LIGHTING, LAMP, HORN, GAUGE & WIRING

Lighting - Purpose and construction of each lamp holder bulbs – Head lamps –Head Lamp Beam setting and adjustments – Halogen lamps – Sealed beam, dip switch – Beam indicator – Fog lamp – Park lamp – Rear number plate lamp – Door Lamp – Pillar Lamp – Roof Lamp – Roof light – Fluorescent lamp in transport vehicles – brake light – Brake light switch – traffic indicators (Resistance & Transistor type) panel lamps.

Horn – Construction – Working – Hum relay – Horn circuit, horn turning, Troubleshooting.

Gauges – Fuel gauge – Oil pressure gauge – Coiling water temperature gauge – Ammeter charging indicator. Radio – Interface – Suppressors – Audio System – Wind screen wipers – Construction – Working – Trouble shooting Pneumatic type wind screen wipers.

Wiring – Single pole – Double pole – Cable size color code – wiring harness – Cable connection – fuses – Circuit breakers – Window glass
panel operating system.

Unit-5

BASIC ELECTRONICS & COMPUTER APPLICATIONS IN AUTOMOBILE

Semi conductor & semi conductor materials (Intrinsic & extrinsic), P type & N type semiconductors, junction diode, forward & reverse bias, knee voltage, maximum forward current, reverse breakdown voltage, zener diodes, transistors(NPN & PNP), Half wave & full wave rectifier, Logic gates- OR, AND, NOT, NAND, EXOR & EXNOR.

Microprocessor control systems: Concept of CPU and computer memory used in automobiles. Sensors: pressure sensor, throttle position sensor, fuel flow sensor, thermistor sensor, oxygen sensor, speed sensors, knock detecting sensors solenoid and stepper motor. Electronic dashboard instruments - Onboard diagnosis system, security and
warning system – ECU – principle and working of ECU.

Text Book

1 Automotive electrical equipments, P.L.Kohli, Tata McGraw hill publications
2 Automobile Electrical and Electronics Systems, Tom Denton, Arnold, London

Reference Book

1 Automotive electrical equipment, A.P. Young and L.Griffidis, English language book society & New press
2 Automotive electrical equipment, W.H. Crouse, Mc. Graw hill book co. inc. New York
3 Automotive Electrical and electronic system, Bosch – SAE
4 Automotive Electronics and Electrical equipment by William H. Crouse and DL. Anglin, McGraw Hill company.
5 Modern Electrical Equipment of Automoblies, Judge. A.W. Chapman & Hall, London, 1992.
6 Automobile Electrical Equipment, Crouse. W.H., McGraw Hill Book Co. Inc., New York, 1980.
7 Automobile Engineering, KM Gupta, Umesh Publishers
8 Automobile Engineering, RB Gupta, Satya Prakashan, New Delhi

Course Title	ENERGYSYSTEMS ENGINEERING				B. Tech. ME VI Sem			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
1803611	OEC-1	3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

The student is able to know the:

- Different sources of energy.
- Working principles of various steam power plants.
- Working principles of various Hydro power plants
- Working principles of various gas and Nuclear power plants.
- Knowledge of various power plants economics.

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

CO 1	Understand the concept of powerplant engineering and its applications.
CO 2	Know Different sources of energy systems
CO 3	Analyze Working and performance of various power plants like steam, hydro ,gas and nuclear power plants
CO 4	Estimate Power plants economics like various tariffs etc
CO5	Evaluate different types of loads

UNIT – I

Introduction to different Sources of Energy.

STEAM POWER PLANT: Layout of Modern Steam Power Plant, working of different circuits-selection of site- Coal Storage- Classification of coal handling and Ash handling systems.

UNIT II

STEAM POWER PLANT: overfeed and underfeed fuel beds, traveling grate, spreader grate and retort grate stoker firing systems - different types of burners - pulverized fuel burning system and its components - cyclone furnace-Dust collectors-Cooling Towers.

UNIT – III

HYDRO ELECTRIC POWER PLANT: Selection of Site for Hydro Electric Power Plant - Hydrological cycle – Hydrographs - flow duration curve - mass curve – classification of dams, spill ways and surge tanks.

HYDRO PROJECTS AND PLANT: Classification of Hydro Electric Power Plants – Typical layout – plant auxiliaries – plant operation - pumped storage plants.

UNIT – IV

NUCLEAR POWER PLANT: Nuclear fuel – breeding and fertile materials – Nuclear reactor –reactor operation.

TYPES OF REACTORS: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast Breeder Reactor, Homogeneous Reactor and Gas Cooled Reactor - Radiation hazards and shielding – radioactive waste disposal.

UNIT V

GAS TURBINE POWER PLANT: Introduction – Plant Layout – Classification – Working of Simple Gas Turbine Power Plant– Constant pressure and constant volume Gas Turbine Power Plants –Combination of Gas Turbine Cycles.

UNIT – VI

POWER PLANT ECONOMICS: Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor, utilization factor, Plant capacity factor and plant use factor - Types of loads - Load curve and load duration curve - general arrangement of power distribution –Different types of tariff for Electrical energy - Simple problems .

TEXT BOOK:

1. A Text Book of Power Plant Engineering, Rajput. R.K., 4/e, Laxmi Publ.
2. A Course in Power Plant Engineering, Arora and S. Domkundwar.

REFERENCES:

1. Power Plant Engineering, P.K.Nag, 2/e, TMH.
2. Power Plant Engineering, Nagpal,
3. Power plant Engineering, Ramalingam, Scietech Publ.
4. Power Plant Engineering, C. Elanchezian and others, I.K. International.

Course Title	ROBOTICS AND APPLICATIONS IN MANUFACTURING				B. Tech. ME VI Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803612	**OEC-1**	3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- In the present scenario all the manufacturing industries are automated to improve the productivity.
- To improve quality of the product

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

CO 1	The student should understand the some fundamental aspects and an overview of robotics& automation, including Components of the Industrial Robotics, arms, architecture, end effectors,
CO 2	Emphasis is placed on understanding motion analysis described mathematically.
CO 3	The Manipulator Kinematics, D-H notation joint coordinates and world coordinates, forward and inverse kinematics are also considered in some detail.
CO 4	Describe construction and working of different types robots
CO 5	Know the working of different sensors

UNIT – I

INTRODUCTION TO AUTOMATION: Automation - need-types, Basic elements of an automated system, levels of automation- computer process control, Forms of computer process control, sensors, actuators, input/output devices for discrete data, overview of material handling equipment

UNIT – II

NUMERICAL CONTROL: Introduction-NC Procedure, NC Coordinate systems, elements of NC Systems, classification of NC Systems, Advantages and dis-advantages of NC Systems, Applications of NC, NC Manual Part programming, APT Language.

UNIT – III

MANUAL ASSEMBLY LINES AND TRANSFER LINES: Fundamentals of Manual Assembly lines and automated production lines, Alternative assembly systems, Design for Assembly, Applications of Automated production lines, Analysis of Transfer lines with NO Internal storage, Analysis of Transfer lines with storage Buffers.

UNIT – IV

INTRODUCTION TO INDUSTRIAL ROBOTS: Robotics Definition - robot configurations, Work volume, Robot Anatomy, Robot Drive systems, Precision of Movement, End effectors, Robotic sensors and actuators, Grippers.

UNIT – V

MANIPULATOR KINEMATICS: Homogeneous transformations as applicable to rotation and translation - (D-H) notation, Forward and inverse kinematics.

Manipulator Dynamics: differential transformation, Jacobians, Lagrange – Euler and Newton Euler formations.

UNIT – VI

ROBOT ACTUATORS AND FEED BACK COMPONENTS: Actuators- pneumatic-hydraulic actuators, Electric & stepper motors, comparison, Position sensors – potentiometers- resolvers- encoders – velocity sensors-tactile sensors-proximity sensors, Robot applications in Manufacturing.

TEXT BOOKS:

1. Mikell P. Groover, Automation, Production Systems and CIM, Prentice-Hall of India Pvt. Ltd.
2. M.P. Groover, Industrial Robotics, TMH.

REFERENCE BOOKS:

1. K.S.Fu., R.C.Gonzalez, C.S.G. Lee, Robotics: Control Sensing, Vision and Intelligence International Edition, McGraw Hill Book Co.
2. P. Coiffet and M.Chaironze, An Introduction to Robot Technology, Kogam Page Ltd. London.
3. Richard. D.Klafter, Robotics Engineering, Prentice Hall
4. Ashitave Ghosal, Robotics, Fundamental Concepts and analysis, Oxford Press
5. Mittal R.K & Nagrath IJ, Robotics and Control, TMH.
6. John. J. Craig, Introduction to Robotics, Pearson.

Course Title	Machine tools Lab				B. Tech. ME VI sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803613	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	-	3	1.5	50	50	100
Mid Exam Duration:					End Exam Duration: 3Hrs		

Course Objective:

The students are required to understand the parts of various machine tools and operate them. They are required to understand the different shapes of products that can be produced on these machine tools.

Course outcomes:

The students can operate different machine tools with understanding of work holders and operating principles to produce different part features to the desired quality.

List of Experiments

1.Demonstration of construction & operations of general purpose machines:Lathe, Drilling machine, Milling machine, Shaper, Planingmachine, Slottingmachine, Cylindrical Grinder, Surface grinder and Tool &cutter grinder.

2. Job on Step turning and taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping
6. Job on Slotting
7. Job on Milling (Gear cutting)
8. Job on Surface Grinding
9. Job on Grinding of Tool angles.

Course Title	HEAT TRANSFER LAB				B. Tech. ME VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803614	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	-	0	3	50	50	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

1. The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer
2. Define the fundamental concepts to students in the area of heat transfer and its applications.
3. Recognize the practical significance of various parameters those are involved in different modes of heat transfer.
4. Apply the knowledge of heat transfer in an effective manner for different applications.

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

CO 1	The student should be able to evaluate the amount of heat exchange for plane, cylindrical & spherical geometries
CO 2	should be able to compare the performance of extended surfaces and heat exchangers
CO 3	Evaluate heat transfer through lagged pipe, Insulating powder and Drop and Film wise condensation.
CO 4	Test Emissivity, Stefan Boltzmann Constant and Critical Heat flux.
CO5	Measure the Heat transfer coefficient for Pin Fin, Forced convection, Natural Convection and parallel and counter flow heat exchanger

Section A: HEAT TRANSFER STREAM

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Overall heat transfer co-efficient through Composite Slab Apparatus
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Heat transfer coefficient in forced convection.
7. Heat transfer coefficient in natural convection
8. Experiment on Parallel and counter flow heat exchanger.
9. Experiment on Stefan Boltzman Apparatus.
10. Study on Vapor compression Refrigeration system
11. Study on Air condition unit

Section B: DYNAMICS STREAM

1. Experiment on vibration Lab unit.
2. Experiment on gyroscopic unit.
3. Experiment on Balancing unit.
4. Experiment on whirling shaft Apparatus
5. Experiment on Cam Apparatus
6. Experiment on Governor Apparatus

NOTE: 1.Choose any six experiments from Heat Transfer stream and any four from Dynamics stream .

2. Heat Transfer data books are permitted in the examinations.

<table>
<tr><td>Course Title</td><td colspan="5">INTERNSHIP</td><td colspan="3">B. Tech. ME VI Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1803615</td><td rowspan="2">PROJECT</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>2</td><td>100</td><td></td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration:</td><td colspan="4">End Exam Duration:</td></tr>
<tr><td colspan="9">o Course Objectives: The objective of the project is to enable the student to take up investigative study in industry in the field of Mechanical Engineering and Ability to articulate what was learned and how it will be apply to their professional career goals.</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">Append to their internship contract, a statement of at least 250 words which explains how this internship contributes to their academic and career goals</td></tr>
<tr><td>CO 2</td><td colspan="8">Identify and transfer existing ideas into new contexts and applications</td></tr>
<tr><td>CO 3</td><td colspan="8">Apply and transfer academic knowledge into the real-world</td></tr>
<tr><td>CO 4</td><td colspan="8">Design a component or a product applying all the relevant standards and with realistic constraints</td></tr>
</table>

The following are the rules and regulation for **INTERNSHIP :**

6. The student has to spend 40 to 50 Hrs in the semester on any Internship and submit a report for evaluation.
7. The project is evaluated for 100 marks in the semester by a committee consisting of head of the department, project mentor and one senior faculty member of the department.
8. A student shall acquire 2 credits assigned, when he/she secures 50% or more marks from the total of 100 marks.
9. In case, if a student fails, he/she shall resubmit the report.
10. There is no external evaluation for the Internship.

Semester VII (Fourth Year)

Course Title	CAD/CAM				B. Tech. ME VII Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1803701	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	1	0	3	30	70	100
INTERNAL Exam Duration: 2Hrs					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 to:

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 geometric models in a computer program,

Understand the possible applications of the CAD/CAM systems in motion analysis, structure analysis, optimization, rapid prototyping, reverse engineering and virtual engineering,

Course outcomes: **CO1**.Students are able to understand Automation, components of CAD/CAM, input and output components of CAD and Steps involved in computer aided design.

CO2. Students are able to understand the geometric model of the component in CAD technology of computer graphics. The techniques of raster technology, scan conversion, clipping, removal of hidden lines and hidden surfaces, color, shading and texture.

CO3.Geometric Modeling constitutes the most important and complex part in most of CDA software packages. Hence the students should focus on various requirements of information that are generated during geometric modeling stage, various types and its applications.

CO4. Understand the need of computers in process planning and QC. Understand the definition and concept of FMS, and its elements etc.

MAPPING OF PO AND CO

Influence of the course outcome (1-Low, 2-Medium, 3- High)

UNIT-I Fundamentals of CAD - design process - Applications of computers for design benefits of CAD - Computer peripherals for CAD - Design work station - Graphics terminal.Introduction of part programming

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. CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition, 2010

3.CAD/CAM By Ibrahim Zeid ,R.siva ubramanyam , Mcgraw Higher Ed

References: 1. Computer Graphics : PlastockSchaum Series,2006

2. Interactive Computer Graphics: Newman &Sproul,2012

3. Computer Graphics: Steven Hamington

Course Title	Finite Element Methods(FEM)					B. Tech. ME VIII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803702	pcc	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	2	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

COURSE OBJECTIVES:

1.To learn the Fundamental of Finite Element analysis

2.To Implement the basics of FEM to relate stresses and strains.

3. To Solve 1 D, 2 D and dynamic problems using Finite Element Analysis approach.

4.To.Formulate the design and heat transfer problems with application of FEM.

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

CO 1	Students are able to implement numerical methods to solve mechanics of solids problems.
CO 2	Students are able to write and Formulate and Solve axially loaded bar Problems.
CO 3	Students are able to write and Formulate and analyze truss and beam problems.
CO 4	Students are able to Implement the formulation techniques to solve two-dimensional problems using triangle and quadrilateral elements.
CO5	Students are able to write and Formulate and solve Numerical Integration and heat transfer problems

Unit -I

Introduction To Fem, Basic Steps, Advantages and Limitations of Fem.,Equilibrium Equations in elasticity subjected to body force, traction force and point loads, stress strain relations in 3D elasticity, variation methods-potential energy method, Rayleigh Ritz method, Galerkin's and weighted residual methods.

UNIT-II

Interpolation models: Introduction, Types of interpolation models, Polynomial form of interpolation models, Simplex, Complex and Multiplex elements, Problems on One Dimensional Finite methods bar elements, Solution for Displacement ,Reaction, Stresses, Temperature effects, Element matrices, Assembling of Global stiffness matrix.

UNIT- III

Trusses and beams: Element Stiffness matrix, assembling of Global stiffness matrix, solution for displacements, reaction, stresses, Deflections.

Unit –IV

Two Dimensional problems- Introduction, Plane stress and Plane strain condition, CST elements, Shape function of CST element, Strain displacement matrix [B] for CST element, Stress strain relationship matrix [D],

Stiffness matrix equation for CST element, Temperature effects Iso-parametric Formulation concepts ,sub parametric ,super parametric Elements Derivations and problems .

Unit –V

Numerical Integration, Heat transfer problems one dimensional, conduction and convection, Temperature distribution through composite walls, One Dimensional fin – problems.

TEXT BOOKS:

1. *Finite Element Analysis* By P. SESHU

1. An Introduction to Finite Element Method, JN Reddy, TMH (2017)

2. Finite Element Method, its basics and fundamentals, O.C.Zienkiewicz, Elsevier (2019)

REFERANCES

1. Fundamentals of Finite element analysis, David V Hutton, TMH (2018)

2. Finite Element Analysis, G. Laksminarasaiah, B.S.Publ. (2020)

3. Textbook of Finite Element Analysis by P. Seshu PHI Publishers 6. Finite Element Methods in Engineering, SS Rao, Pergamum, (2020)

Course Title	QUALITY ENGINEERING MANAGEMENT				B. Tech. ME VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803703	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	2	30	70	100
INTERNAL LAB Exam Duration: 3Hrs					End Exam Duration: 3Hrs		

COURSE OBJECTIVES:

Demonstrate the approaches and techniques to assess and improve process and/or product quality and reliability.

• Introduce the principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring

• Illustrate the basic concepts and techniques of modern reliability engineering tools

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

CO 1	. Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability
CO 2	Use control charts to analyze for improving the process quality.
CO 3	Describe different sampling plans
CO 4	Acquire basic knowledge of total quality management
CO5	Understand the concepts of reliability and maintainability

UNIT I

Quality value and engineering – quality systems -Quality engineering in product design and production process – system design –parameter design – tolerance design, Quality costs – quality improvement, concepts of Total quality management – brief introduction

UNIT II

Statistical Process control -X, R, p, c charts, other types of control charts, process capability, process capability analysis, process capability index. Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plan.

UNIT III

Loss function, tolerance design – N type, L type, S type; determination of tolerance for these types. Online quality control– variable characteristics attribute characteristics, parameter design.

UNIT IV

Quality function deployment –House of quality, QFD matrix, and total quality management concepts. Quality information systems, quality circles, introduction to ISO 9000 standards.

Reliability– Evaluation of design by tests - Hazard Models, Linear, Raleigh, Weibull.Failure Data Analysis, reliability prediction based on weibull distribution, Reliability improvement.

UNIT V

Complex system Reliability, reliability of series, parallel, standby systems, reliability prediction and system effectiveness. Maintainability Availability, economics of reliability engineering, replacement of items, maintenance costing and budgeting, reliability testing.

Text Books:

1. Statistical Process Control, by Eugene Grant, Richard Leavenworth, McGraw Hill. Education; 7th edition , 2017

2. Quality Engineering in Production Systems, by G Taguchi , McGraw Hill, 1989.

3. Optimization &Variation Reduction in Quality, byW.A. Taylor,Tata McGraw Hill,1991.

Reference Books:

1. Jurans Quality Planning and Analysis, by Frank. M.Gryna Jr. McGrawHill McGraw Hill Education; 5th edition ,2017

2. Taguchi Techniques for Quality Engineering, (2ndEdition) by **Phillip J. Ross,**,McGraw Hill, 2005.

3. Reliability Engineering, (3rdEdition), by LS Srinath, Affiliated East West Pvt Ltd, 4th edition ,2005.

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Course Title	PRODUCTION AND OPERATIONS MANAGEMENT				B. Tech. ME VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803704	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

To get acquainted with the basic aspects of production management
To learn techniques of PERT and CPM and its application to management of projectTo learn various scheduling and sequencing techniques
To study different types of production systems
To learn various quality and productivity improvement techniques

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

CO 1	**Students can get the concepts on Production planning & controls operations and its functions, productivity and productivity measurements, design of goods and services and aggregate planning.**
CO 2	**Students can understand the importance of forecasting, uses of long term and short term forecasting and application of qualitative and quantitative methods for finding the future demands.**
CO 3	**Students will be able to understand where the plant is to be located based on facilities available and what are the important factors affecting the facilities location of a plant, and plant layout and also able to understand plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time. Can compare the rural & urban sites, methods of selection**
CO 4	**Students can understand the concepts of Inventory, Classification, Functions, its associated costs etc., and also able to recognize the importance of Inventory control to ensure their availability with minimum capital lock up. and PERT& CPM etc.,**
CO5	**CO5. Students will be able to understand the scheduling policies, flow shop and job shop scheduling techniques and Sequencing Techniques.**

UNIT – I

Introduction to production and operations management, Production management v/s operations management, Objectives of production and operations management, Benefits of production and operations management

Production systems: Definition, components of production system, Types of

production system, Mass production system, Flow production system, Batch production system, Job shop production system, Project type production system, Flexible production system, Lean production, Agile production, Just in time production system and Jet Tool, Kanban system

UNIT – II

Forecasting: Importance of forecasting, Types of forecasting, their uses, Forecasting techniques, Qualitative methods, Quantitative methods: Regression analysis, Moving average ,Weighted moving average, Exponential smoothing method, Forecast for seasonal variations, Fore cast error: Mean absolute deviation, BIAS, Mean square error , Standard deviation, Tracking signal Aggregate production planning: Master production schedule, Strategies for aggregates planning, Aggregate planning methods.

UNIT – III

Factors affecting facilities location, Methods of evaluating location alternatives: Cost analysis,Profit analysis, Return on investment and Factor rating system.
Types of facilities layout: Product layout, process layout and group technology layout, Travel chart, Relationship chart. Computerized layouts: ALDEP, CRAFT and CORELAP.
Assembly line balancing: Introduction, Objectives, Terms used in line balancing, Line balancing algorithms: Ranked positional weight technique and largest candidate rule

UNIT – IV

Inventory management: Functions of inventories, relevant inventory costs, ABC Analysis and VED analysis, Simple EOQ model, Inventory control systems: P–Systems and Q-Systems(S, s) Policy
PERT and CPM: Terms used in PERT and CPM, Rules for drawing network diagram, CPM, PERT, Crashing of network, Resource management, Resource allocation, Resource aggregation, Resource leveling and applications of PERT and CPM, Case studies.

UNIT – V

Loading and scheduling: Terms used in scheduling, Factors affecting scheduling, Objectives of scheduling, Methods used in scheduling: Forward scheduling backward scheduling and Gantt chart
Sequencing: Priority sequencing rules, Johnson algorithm: n jobs through two machines, n jobs through three machines, n jobs through m machines
Material requirement planning, Capacity planning and production control

TEXT BOOKS:

1. Analysis of production systems and Operations and production Management, Rajagopal Kurnool, CBS publishers,2019
2. Modern Production, Operations Management, Baffa&RakeshSarin,2017
3. Operation Management, B. Mahadevan, Pearson Edu,2012

REFERENCES:

1. Operations Management, S.N. Chary,2006
2. Inventory Control Theory and Practice, Martin K. Starr and David W. Mille,2005

3. Operations research by HAMDAY.A.TAHA , 2018

course Title	Rapid prototyping				B. Tech. ME VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803705	**PCC**	3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

1. To study the basics of RPT
2. To study the various process in RP
3. To study the principles of Rapid tooling and reverse engineering
4. To study the Rapid tooling-Direct ,Indirect soft & Hard tooling
5. To study various Erros in stl Files

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

CO407.1	At End of semester student gains knowledge on various types rapid Prototyping techniques
CO407.2	Student Gains Knowledge in various operation principles and applications of liquid based Rp systems
CO407.3	Students Gains Knowledge in various solid based Rapid prototyping
CO407.4	At the end of semester student gains knowledge in Lom process and concept modellers
CO407.5	Student gain knowledge in direct and indirect tooling and part building errors,software for Rp

Unit-I

Introduction: Need for the compression in product development, History of RP system, Surveyof applications, Growth of RP industry and classification of RP system.

Unit_II

Stereo Lithography System: Principle, Process parameter, Process details, Data preparation,Data files and machine details, Applications.

Unit III

Fusion Decomposition Modeling: Principle, process parameter, Path generation,

Applications.

Solid ground curing: Principle of operation, Machine details, Applications,

Unit IV

Laminated Object Manufacturing: Principle of Operation, LOM materials, Process details, Applications

Concepts Modelers: Principle, Thermal jet printer, Sanders model market, 3-D printer,GenisysXs printer HP system, Object Quadra system.applications.

Unit –V

Rapid Tooling: Direct soft tooling- selective laser sintering of sand casting molds, Direct ACES injection molding, SL composite tooling, Indirect soft tooling-Arc spray metal tooling, silicone rubber molds, spin casting with vulcanized rubber molds, Castable resin molds, Castable ceramic molds, Plaster molds ,casting, Direct Hard tooling-Rapid tool, laminated metal tooling, Direct metal laser sintering tooling, Pro metal rapid tooling, Indirect Hard tooling- 3D keltool, EDM Eletrodes ,Eco tool, copy milling
Software for RP: STL files, Overview of Solid view, magics, imics, magic communication, etc.Internet based software, Collaboration tools. Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data preparation error, Part building error, Error in finishing, Influence of build orientation.

TEXT BOOKS:

1. " Stereo lithography and other RP & M Technologies**"**, Paul F.Jacobs, SME, NY 2016
2. " Rapid Manufacturing **",** Flham D.T &Dinjoy S.S, Verlog London 2012
3. "Rapid automated**"**, Lament wood, Indus Press New York,2008

REFERENCES:

1.Rapid Prototyping",Priniciples and Applications**,** Chee Kai Chua, Kah Fai Leong, Chu Sing Lim, World Scientific, 2010 - Technology & Engineering

2.Rapid Protoyping by Rafiq Noorani Wiley, 2006 - Technology & Engineering -

3.Rapid prototyping Technology, Selection and Applications,kenneth copper Taylor & Francis, 09-Jan-2001 - Technology & Engineering

Course Title	Mechatronics					B. Tech. ME VIII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803706	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

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

CO 1	**Discuss the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.**
CO 2	Discuss the architecture of Microprocessor and Microcontroller, Pin Diagram, Addressing Modes of Microprocessor and Microcontroller.
CO 3	**Discuss Programmable Peripheral Interface, Architecture of 8255 PPI, and various device interfacing.**
CO 4	**Explain the architecture, programming and application of programmable logic controllers to problems and challenges in the areas of Mechatronic engineering.**
CO5	Discuss various Actuators and Mechatronics system using the knowledge and skills acquired through the course and also from the given case studies.

UNIT I INTRODUCTION 9

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

UNIT II MICROPROCESSOR AND MICROCONTROLLER 9

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE 9

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER 9

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN 9

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

TEXT BOOKS:

1. Bolton, “Mechatronics”, Prentice Hall, 5th edition, October 2011.
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, 6th Edition, Prentice Hall, 2013.
3. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurement systems”, McGraw Hill International edition, 2007.

REFERENCES:

1. Bradley D.A, Dawson D, Buru N.C and Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
2. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013
3. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company, 2007.

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Course Title	Flexible Manufacturing Systems					B. Tech. ME VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803707	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

1. To expose the student to the different types of manufacturing available today such as the Special Manufacturing System, the Manufacturing Cell, and the Flexible Manufacturing System (FMS)
2.. To learn the fundamentals of computer assisted numerical control programming and programming languages
3.To practice the PLC control devices and CNC operation skills.
4. To understand the design, planning and operational concepts of FMS and learn about the different tools and techniques for analyzing the same..

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

CO 1	Understand FMS and job-shop and mass production manufacturing systems
CO 2	Knowledge of concept and design of flexible manufacturing cells.
CO 3	Explore processing stations and material handling systems used in FMS environments.
CO 4	Analyze the production management problems in planning, loading, scheduling, tool management and breakdown in a typical FMS
CO5	Design and analyze FMS using analytical techniques.

Unit I

Understanding of FMS: Classifications of Manufacturing Systems, Definition, Objective and Need, Components, Merits, Demerits and Applications of FMS. Design of FMS: Performance Evaluation, Analytical models of FMS

UNIT II

Flexible Manufacturing Cell: Introduction to group technology, Benefits of group technology, Part family, Methods of grouping the parts into part family: The visual inspection method, Part classification and coding system, MICLASS classification and coding system, Opitz classification system, Production flow analysis , Composite part, Limitations of group technology, Application of group technology

UNIT III

FMS Processing Stations: Machining Centers, Turning centers, CMM, Washing/ Deburringstation. Different types FMS Layouts.

Unit –IV

Material Handling Systems: An introduction, Conveyor, AGV, ASRS, Robots, etc. and their salient features.

Unit –V

Management Technology: Tool Management, Configuration planning and routing, Production Planning and Control, Scheduling and control, Computer Networks and Control

TextBooks:

1.Groover,M.P "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt.Ltd. New Delhi 2012

2.Tempelmeier.H and Kuhn.H. "Flexible Manufacturing system: Decision support for design and operation", John Wiley and Sons 2013.

3. Maleki A. "Flexible Manufacturing Systems: the technology and management". Prentice Hall International –2009

Reference Books :

1.Operations Management, S.N. Chary. 2006

2. Inventory Control Theory and Practice, Martin K. Starr and David W. Miller. 2010

3. Flexible manufacturing systems by William Logan ,2015.

Course Title	Computer Graphics					B. Tech. ME VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803708	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

1.The students will learn principles and practices used in the creation of 3D models;

2.Understand mathematical principles of geometric modeling; theory and application of modeling techniques,

3. Study the representation schemes for curves, surfaces, solids, and other spatial data and the impact of representation on graphics algorithms. Topics include spline curves and surfaces, quadric surfaces,

4.design and analyze algorithms and systems for interactive 3D shape modeling

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

CO 1	student can able to understand to various display devices and algorithms
CO 2	student can able to understand applications of geometric modeling techniques
CO 3	student can able to understand various clipping algorithms
CO 4	Gains Knowledge Various transformations and shading algorithms

Unit I

Introduction to computer graphics: Color CRT raster scan monitors, plasma display & liquid crystal display monitors, computer input devices, hard copy devices. Raster scan graphics: Line drawing algorithms – DDA &Bresenham‟s algorithms, circle generation, general function rasterization, displaying lines, characters and polygons. Filling algorithms: polygon filling, edge fill algorithm, seed fill algorithm.

UNIT II

Line clipping: Simple visibility algorithm, Cohen-Sutherland subdivision line clipping algorithm, midpoint sub division algorithm. Polygon clipping: polygon clipping, reentrant polygon clipping – Sutherland – Hodgeman algorithm, character clipping, 3D- clipping.

UNIT III

Transformations: Cartesian and homogeneous coordinate systems two dimensional and three dimensional transformations – scaling, rotation, Shearing, Zooming, viewing transformation, reflection, rotation about an axis, concatenation.

Unit –IV

Rendering: Hidden line removal algorithms, surface removal algorithms, painters, Warnock, Z-buffer algorithm.

Unit –V

Shading algorithms: Constant intensity algorithm, Phong‟s shading algorithm, gourand shading algorithm, Comparison of shading algorithms

TextBooks:

1. Mathematical Elements for computer graphics, David. Rodgers, TMH ,2014
2. Computer Graphics C version, Donald Hearn and M.PaulineBaker,Pearson/PHI publisher 2017
3. Computer Graphics Principles & Practice, C.Foley, Vndom, Fener, Hughes,2/e, Pearson Publications,2005

Reference Books :

1. CAD/CAM Theory, Ibrahim Zeid, TMH L,2006
2. Computer Graphics second edition, Zhigandxiang, Roy Plastock, 2000, Schaum‟soutlines, TMH.
3. Computer Graphics, Steven Harrington, TMH

Course Title	INDUSTRIAL SAFETY				B. Tech. ME VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803709	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:

1. To understand need for safety, safety lustration, safety policy.

2. To understand hazard identification such as Mechanical, Electrical, Chemical hazards and safety in material handling.

3. To understand the safety in hazards machines such as Welding, Hot working, Cold working.

4. To understand the importance of training, conferences, method of promoting safe practices.

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

CO 1	Asses the need for safety, acts, safety policy, safety standards.
CO 2	Understand the methods of hazard identification.
CO 3	Analyze the use of material handling.
CO 4	Understand the techniques of safety in various manufacturing methods.
CO 5	Understand the importance of training, need, roll of government agencies in industries safety.

Unit I: Introduction to Industrial Safety

History and development of industrial safety movement, Need for safety, **Safety legislation:** Acts and rules, Safety standards and codes, **Safety policy:** safety organization, responsibilities and authorities of different levels**.**

Unit II: Hazard Identification

Identification of hazard, Categorization methods for elimination of hazard, **Mechanical hazards:** machine guarding, safety with hand tools/ portable power tools, Pressure vessel hazards and their control,

Electrical hazards: classification, safe work practices,

Chemical hazards: laboratory safety, bulk handling of chemicals,

Unit III: Safety In Material Handling

General safety: consideration in material handling -Ropes, Chains, Sling, Hoops, Clamps, Arresting gears –Prime movers.

Selection, operation and maintenance of Industrial Trucks: Mobile Cranes – Tower crane –Checklist -Competent persons.

Unit IV: Safety in Engineering Industry

Introduction – Safety in Operations of Hazardous Machines – Safety in welding and gas cutting – Safety in cold forming and hot working of metals – Work Permits for hot Work and Cold Work – Safety of Pressure vessels.

Unit V: Safety Education And Training

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions –method of promoting safe practice -motivation –communication -role of government agencies and private consulting agencies in safety.

TEXTBOOKS:

1. Grimaldi and Simonds , Safety Management, AITBS Publishers , New Delhi (2001)
2. R.K.Jain and Sunil S.Rao , Industrial Safety, Health and Environment Management Systems, Khanna publishers , New Delhi (20016)
3. “Industrial safety management”, L M Deshmukh, TATA McGraw Hill, 2010

References

1. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 2018.
2. John Ridley, “Safety at Work”, Butterworth & Co., London, 2010.

3. Frank P.Lees,Loss of prevention in Process Industries , Vol. 1 and 2, Butterworth-HeinemannLtd., London (2019).

Course Title	INDUSTRIAL SAFETY & MANAGEMENT				B. Tech. ME VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1803710	**OEC-II**	**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:

1. **To understand the roles, functions, duties and responsibilities of various levels of management and employees in planning, organizing, directing, controlling and monitoring the safety management system and safety related activities.**
2. **To investigate the accidents and analyze and arrive at all-round surveillance findings for the root causes of accidents.**
3. **To implement the safety policy of the organization framed under the system to achieve safety related activities.**

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

CO 1	**Analyze the effects of release of toxic substances.**
CO 2	**Select the methods of prevention of fires and explosions.**
CO 3	**Understand the methods of hazard identification and prevention.**
CO 4	**Assess the risks using Fault Tree Diagram.**
CO5	**Understand the techniques of safety Management**

UNIT – I

Introduction: Safety Programs, Engineering Ethics, Accident and Loss Statistics, Acceptable Risk, Public Perceptions, the Nature of the Accident Process, Inherent Safety.

UNIT II

Industrial Hygiene: Anticipation and Identification, Hygiene Evaluation, Hygiene Control.

Toxic Release and Dispersion Models-Parameters Affecting Dispersion, Neutrally Buoyant Dispersion Models, Dense Gas Dispersion, Toxic Effect Criteria, Effect of Release Momentum and Buoyancy, Release Mitigation.

UNIT III

Fires and Explosions: The Fire Triangle, Distinction between Fires and Explosions, Flammability Characteristics of Liquids and Vapors, Limiting Oxygen Concentration and Inerting, Flammability Diagram

Unit –IV

Hazards Identification: Process Hazards Checklists, Hazards Surveys, Hazards and Operability Studies, Safety Reviews.

Unit –V

Risk Assessment: Review of Probability Theory, Event Trees, Fault Trees. Safety Procedures: Process Safety Hierarchy, Managing Safety, Best Practices, Procedures-Operating, Procedures-Permits, Procedures-Safety Reviews and Accident Investigations.

TEXT BOOKS:

1. J Maiti. Pradip Kumar Ray, " Industrial Safety Management - 21 st Century Perpectives of Asia", Springer Singapore, 2018
2. M.P Poonia, S.C. Sharma, " Industrial Safety and maintenance Management", Khannaa Publishers, 2017
3. Lakshmikanth M. Deshmukh "Industrial Safety Management - Hazard Identification and Risk Control", The McGraw Hill Company, 2005

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1. D. A. Crowl and J.F. Louvar, “Chemical Process Safety (Fundamentals with Applications)”, Prentice Hall, 2011.
2. R K Jain and Sunil S Rao, “ Industrial Safety and Environment Management Systems”, Khanna Publishers, January 2000
3. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay,1997.

Course Title	SMART MATERIALS				B. Tech. ME VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803711	OEC	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:

1. To understand the concept of The Variety of Smart materials
2. To understand the Essential Characteristics of Fibre- optics Material from the view point of Industrial Application
3. To understand the concepts of Smart Sensor, Actuator and Transducer Technologies
4. To Understanding the concept of Shape Memory Materials
5. To understand the varies Case studies of MEMS Product development Performance, Accuracy, Repeatability, Reliability,

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

CO 1	understand the principle concepts of Smart materials ,importance and its Role of interface in Smart Materials
CO 2	Analyze the basic concepts of the Essential Characteristics of Fibre- optics Material
CO 3	knowledge about Various types of Smart sensors, and Transducer
CO 4	Select the proper concepts of Shape Memory Materials
CO5	Evaluate different Case Studies of Performance,Accuracy,Repeatability and Reliability of Smart Materials

UNIT-I

Smart materials

Piezoelectric Materials : introduction to Cantilever Piezoelectric actuator model, Properties of Piezoelectric materials, Applications.

Elecro-Restrictive Materials: Properties and Applications of Elecro-Restrictive Materials.

Magneto-Restrictive Materials: Properties and Applications of Magneto-Restrictive Materials

UNIT-II

Fiber-Optic Sensors

Introduction, Physical Phenomenon, Characteristics, Fibre optic strain sensors, Twisted and Braided Fibre Optic sensors, Optical fibres as load bearing elements, Crack detection applications, Integration of Fibre optic sensors

UNIT – III

Smart Sensor, Actuator and Transducer Technologies

Smart Sensors: Accelerometers; Force Sensors; Load Cells; Torque Sensors Pressure Sensors; Microphones; Impact Hammers; MEMS Sensors; Sensor Arrays Smart Actuators; Displacement Actuators; Force Actuators;

Power Actuators: Vibration Dampers; Shakers;

fluid actuators: Fluidic Pumps; Motors;

smart Transducers: Ultrasonic Transducers; Sonic Transducers.

UNIT- IV

SHAPEMEMORYMATERIALS

classification of SMA alloys- mechanism of magnetic SMA – applications of SMA – continuum applications of SMA fasteners – SMA fibers – reaction vessels, nuclear reactors, chemical plant, etc. – micro robot actuated by SMA – SMA memorization process (Satellite Antenna Applications) SMA blood clot filter – Impediments to applications of SMA – Shape memory polymers– mechanism of shapememory-Primary moulding – secondary moulding – types and applications.

UNIT-V

Case Studies

MEMS Magnetic actuators, BP sensors, Microphone, Acceleration sensors, Gyro, MEMS Product development: Performance, Accuracy, Repeatability, Reliability, Managing cost, Market uncertainties, Investment and competition

TEXT BOOKS:

1."Smart Structures –Analysis and Design", A.V.Srin ivasan, Cambridge University Press, New York, 2001,

2. "Smart Materials and Structures", M.V.Gandhi and B.S.Thompson Chapmen & Hall, London, 2006

3. "Foundation of MEMS, by Chang Liu. Pearson Educa tion.

Reference Books

1) Smart Structures and Materials/ B.Cui Shaw/Artech House, Boston, 2006
2) Piezoelectric Sensories: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors. Materials and Amplifiers/ G. Gautschi/ Springer, Berlin; New York,2002
3) Piezoelectric Actuators and wtrasonic Motors/ K.Uchino/ Kluwer Academic Publishers, Boston, 2014

Course Title	QUANTITATIVE ANALYSIS FOR BUSINESS DECISIONS				B. Tech. ME VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803712	**OECIII**	3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To understand the concepts of linear programming techniques
- To obtain knowledge in queuing theory
- To learn simulation techniques
- To understand various sequencing models and application of this models in process planning
- To understand various replacement models in order to make optimum

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

CO 1	Understand the concept of OR and its applications.
CO 2	Describe Transportation and assignment models.
CO 3	Apply group replacement and individual replacement techniques to solve problems.
CO 4	Illustrate game theory and apply decision making to solve problems.

UNIT – I:

Introduction and Linear Programming: Nature and Scope of O.R.–Analyzing and Defining the Problem, Developing A Model, Types of models, Typical Applications of Operations Research; Linear Programming: Graphical Method, Simplex Method; Solution methodology of Simplex algorithm, Artificial variables; Duality Principle, Definition of the Dual Problem, Primal - Dual Relationships.

UNIT – II:

Transportation and Assignment Models: Definition and Application of the Transportation Model, Solution of the Transportation Problem, the Assignment Model, & Variants of assignment problems. Traveling

Salesman Problem.

UNIT – III:

Replacement Model: Replacement of Capital Cost items when money's worth is not considered, Replacement of Capital Cost items when money's worth is considered, Group replacement of low-cost items.

UNIT – IV:

Game Theory and Decision Analysis: Introduction – Two Person Zero-Sum Games, Pure Strategies, Games with Saddle Point, Mixed strategies, Rules of Dominance, Solution Methods of Games without Saddle point – Algebraic, arithmetic methods. Decision Analysis: Introduction to Decision Theory, Steps In the Decision Making, the Different environments In Which Decisions are Made, Criteria For Decision Making Under Risk and Uncertainty.

UNIT – V:

Queuing Theory and Simulation: Basic Elements of the Queuing Model, Poisson Arrivals and Exponential Service times; Different Queing models with FCFS Queue disciplne: Single service station and infinite population, Single service station and finite population, Multi service station models with infinite population. Queing networks. Simulation: Nature and Scope, Applications, Types of simulation, Role of Random Numbers, Inventory Example, Queuing Examples.

TEXTBOOKS:

1. Operations Research: Theory and Applications/ J. K. Sharma: / Macmillan, 2017..
2. Operations Research/ Er. Prem Kumar Gupta & Dr. D. S. Hira / S. Chana, 2016
3. Operatons research By HAMDAY and TAHA, 2018.

REFERENCE BOOKS:

1. Introduction To Operations Research; Hillier/Lieberman/ TMH, 2020.
2. Render: Quantitative Analysis for Management, Pearson, 2015.
3. Quantitative Methods for Business/ Anderson, Sweeney, Williams/ 10/e, Cengage, 2008

Course Title	ENTREPRENEURSHIP				B. Tech. ME VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1803713	**OEC III**	**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:

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

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

CO 1	Identify opportunities and deciding nature of industry
CO 2	Brainstorm ideas for new and innovative products or services
CO 3	Analyze the feasibility of a new business plan and preparation of Business plan
CO 4	Use project management techniques like PERT and CPM
CO5	Analyze behavioural aspects and use time management matrix

UNIT-I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis,Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

References:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.
3. Sudha G.S., "Organizational Behavior", National Publishing House, 1996.

Course Title	Metrology lab				B. Tech. ME VIII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803714	PCC-ME703	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	3	50	50	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

1. 1. The objectives of this course are to:

1. Learn the main principle on which different instruments operate and provide hands on experience on them.
2. Generate knowledge and skill in use of precision instruments.
3. Learn a basic understanding of various instruments used in linear and angular

Measurements.

1. Get familiarize with usage of tool makers microscope.
2. Learn a basic understanding of the instruments used for measurement of pressure,

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

CO 1	Develop quality standards of engineering products in industries.
CO 2	Demonstrate work in quality control departments of industries and to ensure quality of products.
CO 3	Analyze the measurement of the surface roughness and perform alignment tests.
CO 4	Develop the ability to apply the principles in instruments and measuring techniques.
CO5	Demonstrate work in designing the instrumentation for a particular purpose and special purpose devices.

List of Experiments Conducted in Metrology and Measurements Laboratory

Metrology & Measurements Laboratory

Ex. No	Experiment Title
1.	Calibration and use of measuring instruments – Vernier caliper, Micrometer, Vernier height gauge – using Gage blocks
2.	Calibration and use of measuring instruments – Depth micrometer, Bore gauge, Telescopic gauge
3.	Measurement of linear dimensions using comparators.
4.	Measurement of angles using Bevel protractor and Sine bar.
5.	Measurement of screw thread parameters using Screw thread micrometers and Three wire method (floating carriage micrometer).
6.	Measurement of gear parameters using Disc micrometers, Gear tooth Vernier caliper.
7.	Measurement of screw thread by Non-contact (optical) measurement using Profile projector
8.	Measurement of force using lathe tool dynamometer
9.	Measurement of temperature by using jkt thermo couple
10.	Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus-based instruments.
11.	Testing of straightness of a machine tool guide way using Autocollimator, spindle tests.
12.	Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM).

Course Title	INSTRUMENTATION AND CONTROL SYSTEMS LAB				B. Tech. ME VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803715	PCC	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	0	3	1.5	50	50	100
INTERNAL LAB Exam Duration: 3Hrs					**End Exam Duration: 3Hrs**			

COURSE OBJECTIVES:

1.To enable the students to understand the fundamentals of instrumentation and control available monitoring/measuring in domestic / industrial applications.

2. To learn fundamentals of various types of Transducers.

3. To acquire basic understanding of principle & working of Transducers

4. To understand the methods to analyze the stability of systems from transfer function forms

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

CO 1	Ability to recall the information like displacement, temperature, speed, etc
CO 2	Calculate the low pressure gauges
CO 3	Analyze measurement of vibration amplitude of an engine test bed at various loads
CO 4	TO understand and Discuss Rota meter,
CO5	TO understand LVDT and strain gauges

List of Experiments:

1	Study and calibration of LVDT transducer for displacement measurement
2	Calibration of Resistance Temperature Detector (RTD) for temperature measurement.
3	Study and calibration of Photo speed pickups for the measurement of speed Study and calibration of Magnetic speed pickups for the measurement of speed
4	Calibration of Dead weight Pressure Gauges
5	Calibration of Strain gauge
6	Study and calibration of a Rota meter for flow measurement.
7	Vibration measurement of engine test bead
8	Calibration of J,K,T thermocouples
9	Calibration of McLeod gauge for low pressure.

TEXT BOOKS:

1. Measurement Systems: Applications & design, D.S Kumar.

2. Instrumentation and Control Systems, S.Bhaskar , Anuradha Agencies.

REFERENCES: 1. Measurement systems: Application and design, Doeblin O. Earnest..Adaptation by Manik and Dhanesh, TMH

2. Mechanical Measurements, Beckwith, Marangoni, Linehard, PHI, PE

3. Instrumentation, Measurement & Analysis, B.C.Nakra&K.KChoudhary, TMH

Link Sheets: (*Provide additional references apart from prescribed text books, if any*)

1. **https://en.wikipedia.org/wiki/Instrumentation**
2. **https://en.wikipedia.org/wiki/Instrumentation_and_control_engineering**

Course Title	Minor Project					B. Tech. ME VIII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803716	Project-III	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	5	3	100	0	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- The **objective** of this **mini project** is to let the students apply the programming knowledge into a real- world situation/problem.
- The objective of the minor project is to provide an opportunity for students to undertake short research training outside the classroom to solve real-world issues. That mainly involves the application of geo informatics as a part of its solution.

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

CO 1	**Students will learn to survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.**
CO 2	Students will be able to use different experimentaltechniques
CO 3	**Students will be able to use different software/ computational/analyticaltools**
CO 4	**Students will be able to design and develop an experimental set up/ equipment/testrig.**
CO5	Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzingthem.

This subject will be offered to the final year mechanical engineering students, except those students selected for the major project. Minor Projectenvisages that a student during the final semester will acquire the ability of applying the engineering knowledgeto a practical problem. A student is required tocarry out the project work related to Mechanical Engineering, under the guidance ofafaculty memberand/or the supervisor of the concerned industry/institute/organisation.The student can undertake the project individuallyor in a group of not more than four students.

The project mustcover at least any one area suggested below:

- Design, analysis and/or fabrication,
- Experimentation,
- Product design and development,
- Design and development of laboratory equipments/test rigs,
- Industry needs based basic survey or Testing or Analysis etc.

A report comprising preliminary literature review, objective, methodology and scope of the project work undertaken, duly signed by project guide(s) and head of the department, will be submitted for the end semester examination.

The Minor Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches for mechanical Engineering branch of B.Tech.The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panelsetby HeadandPGcoordinator.Thecandidatehastobeinregularcontactwithhis guide and the topic of dissertation must be mutually decided by the guide and student

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course Title	Introduction to Ansys				B. Tech. ME VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803717	**AUII**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	0	2	0	50	0	0
Mid Exam Duration: 2Hrs					**End Exam Duration:**			

Course Objectives:

6. To study the basics of Finite Element Methods
7. To study the solid Modelling operations
8. To study the About Meshing Elements in Ansys
9. To study the APDL Interface
10. To study Work Interface in Ansys

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

CO417.1	At End of semester student gains knowledge on various FEA Basics Related to Ansys
CO417.2	Student Gains Knowledge in various Selection Logic, Solid Modelling and Boolean operations
CO417.3	Students Gains Knowledge in Various Meshing Techniques
CO417.4	Students Gain Knowledge in APDL Interface
CO417.5	Student Gain knowledge in Work Bench Interface and solve various problems in FEA

Unit-I- Introduction to the Finite Element Method, General Steps of the Finite Element Method, Explanation of 1D, 2D and 3D Elements with examples of ANSYS Elements, Need of FEM, Types of analysis that can be done using ANSYS, Advantages of the Finite Element Method, Limitations of FEA, About ANSYS Inc., ANSYS Family of products with their capabilities, Types of analysis that can be done with ANSYS, Introduction to the Ansys GUI, Operation Modes of Ansys, Product Launcher, Launcher Menu Options, The ANSYS GUI, The Icon Toolbar Menu, Quitting Ansys

Unit_II Selection Logic-Pan-Zoom-Rotate, Picking, Coordinate Systems, Solid Modeling-An Overview of Solid Modeling Operations, Working with Boolean operations, Working Plane, Importing of 3D models

Unit III: Introduction to Meshing-Why do we carry out meshing, Types of Elements, How to Decide Element type, how to start meshing , Meshing Techniques, Meshing in Critical Areas, Mesh Display options**,** Mesh Controls, The ANSYS Mesh Tool, Smart sizing, Meshing, Free Meshing, Mapped Meshing, Hybrid meshing, Mesh Extrusion, Volume Sweeping

Unit IV ANSYS APDL: Introduction, Starting the program, Preprocessing stage, solution stage post Processing Stage, static analysis GUI Method, modal analysis, Harmonic Response Analysis, contact analysis APDL

Unit-V Workbench : Introduction to ANSYS Workbench tool box, Project schematic, The tool Bar, the Menu Bar, Working with views and workspaces, using the chart view, working with units ,Static Structural Analysis, Modal Analysis, Thermal Analysis, Contact Analysis work bench.

TEXT BOOKS:

1. Finite Element Simulations with ANSYS Workbench ,Published September 18, 2015,By Lee, DC Publications
2. ANSYS Tutorial Release 14,Published August 22, 2012,By Kent L. Lawrence, SDC Publications
3. Working With Ansys Tutorial Apporach , Divya Zindani, Apurba Kumar Roy, Kaushik Kumar, I.K, International Publishing House, Pvt Ltd.

REFERENCES:

1.Practical Finite Element Analysis, Nitin S Gokhale, Sanjay S Deshpande, Sanjeev V Bedekar,Anand N thine, publications Finite to Infinite, India

2. ANSYS 11.0 for Designers, CADCIM Technologies, USA,Prof. Sham Tickoo, Purdue University Calumet, USA

3. Engineering Analysis with ANSYS Software,2nd Edition, **Tadeusz Stolarski Y. Nakasone S. Yoshimoto**

Semester VIII(Fourth Year)

S. NO	Course Code	Subject code	Course Title	Hours per week			IM	EM	Total contact hours	credits
				L	T	P				
1	**PEC- IV**	**1803801**	**Refrigeration and air conditioning** **(Professional Elective-IV)**	**3**	**0**	**0**	**30**	**70**	**3**	**3**
		1803802	Modern manufacturing Methods	3	0	0	30	70	3	3
		1803803	Composite & Nano materials	3	0	0	30	70	3	3
		1803804	Introduction to Expert systems	3	0	0	30	70	3	3
		1803805	Computer Aided Process Planning	3	0	0	30	70	3	3
		1803806	Reliability in engineering	3	0	0	30	70	3	3
2	**OEC -IV**	**1803807**	Total quality management	**3**	**0**	**0**	**30**	**70**	**3**	**3**
		1803808	Introduction to IC engines	**3**	**0**	**0**	**30**	**70**	**3**	**3**
3	Project-IV	**1803813**	Major Project	0	0	12	50	50	12	5
4	Seminar-II	**1803814**	Seminar-II	0	0	1	100	0	01	1
									Total credits	**12**
									Total Hours	**19**

Course Title	REFRIGERATION AND AIR CONDITIONING			B. Tech. ME VII Sem
Course Code	Category	Hours/Week	Credi	Maximum Marks

					ts			
1803801(Professional Elective)	**PE**	**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:

1. To enable the students to understand the fundamentals of refrigeration and air conditioning.

2. To learn fundamentals of vapour compression and vapour absorption systems.

3. To study the Steam jet refrigeration and non- conventional refrigeration system.0

4. To study the principles of Psychometric properties and process.

5. To design the air conditioning loads calculations.

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

CO 1	To understand the fundamentals of refrigeration and air conditioning systems
CO 2	To understand the vapour compression and vapour absorption refrigeration system.
CO 3	To understand the steam jet refrigeration and unconventional refrigeration systems
CO 4	Apply the principles of Psychometric properties and process

UNIT – I

Introduction to Refrigeration: - Necessity and applications – Unit of refrigeration and C.O.P. – Different refrigeration methods – Air Refrigeration: Ideal and actual cycle, Open and Dense air systems – Actual air refrigeration system – Refrigeration needs of Air crafts- Fundamentals Air craft systems.

UNIT – II

Vapour compression refrigeration (VCRS) – working, principle of the VCRS – Simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – Problems.

Vapour Absorption Refrigeration System (VARS) – Calculation of max COP – description and working of NH3 – water system – Li – Br system. Principle of operation Three Fluid absorption system, salient features. – Problems.

UNIT – III

Steam Jet Refrigeration system.

Simple treatment of Steam jet refrigeration system, principle and operation of Thermo electric refrigerator and Vortex tube. Testing, Charging and Maintenance of refrigeration and air-conditioning.

Refrigerants – Desirable properties- Classification of refrigerants– Nomenclature – Ozone Depletion – Global Warming of new refrigerants.

UNIT – IV

Introduction to Air Conditioning: Psychometric Properties & Processes – Sensible and latent heat loads – Characterization – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP. Comfort Air conditioning- summer, winter and year round air-conditioning system.

UNIT – V

Concept of human comfort, Effective temperature and comfort charts. Psychological hazards for human comfort – Air Conditioning systems and Air conditioning Load Calculations.

TEXT BOOKS:

1. Acourse in Refrigeration and Air conditioning – Domakundwar , Arora ,dhanapat rai& co , 2014

2. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / Mc Graw Hill ,2012

3. Principles of Refrigeration - Dossat / Pearson, Third edition, 2009

REFERENCE BOOKS:

1. Refrigeration and Air conditioning- R.K.Rajput, S.K.KATARIA&SONS

2. Refrigeration and Air conditioning- R.S.kurmi and JK Gupta, S. Chand publications

3.Acourse in Refrigeration and Air conditioning – CP ARORA , 2014

Tables and codes- Refrigeration and airconditiong charts by Dr.S.S. Banwit & Dr. Laroiya.

Link Sheets: (*Provide additional references apart from prescribed text books, if any*)

3. https://en.wikipedia.org/wiki/refrigeration
4. **ttps://en.wikipedia.org/wiki/refrigeration and air-conditioning**

Course Title	Modern manufacturing methods				B. Tech. ME VIII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803802	**PECIV**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

1.To understand the concept of The Variety of composite materials(Anisotropic materials) vise versa

2. To understand the Essential Requirements of Good Matrix Material from the view point of Industrial Application

3. To understand the concepts of Concretes ,Various types of ceramic composite Materials

4. Understanding the concept of verity Methods of Fabrication processes for Economic Production

5. To understand the Characteristics, Properties and Applications of Modern Materials

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

CO 1	understand the importance and its Role of interface in Composite Materials
CO 2	Analyze the basic concepts of the Essential Requirements of Good Matrix Material
CO 3	knowledge about Various types of ceramic composite Materials, and Hybrid composites
CO 4	Select the proper Fabrication methods of Glasses
CO5	Evaluate different Characteristics, Properties and Applications of Modern Materials

UNIT I

NEED FOR MODERN MANUFACTURING METHODS: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications. Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand importance of non-traditional machining processes, features, classifications and applications of non-traditional methods.

UNIT II

Ultrasonic machining - Elements of the process, mechanics of material removal, process parameters, applications and limitations. Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the processes of USM and AJM, process parameters, application and limitations.

UNIT III

ELECTRO - CHEMICAL PROCESSES:Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.

CHEMICAL MACHINING: Fundamentals of chemical machining- Principle- of material removal- maskants - etchants- process variables, advantages and applications.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the Electro-chemical process and applicable in manufacturing environment in terms of accuracy, surface finish and MRR and their relative advantages.. .and ,rdi.sadvantages. He has to understand the chemical machining advantages and applications.

UNIT IV

THERMAL METAL REMOVAL PROCESSES: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for inoproved

surface finish and nnachining accuracy - Applications of different processes and their limitations. PLASMA MACHINING: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the types of thermal based metal removal processes, principle of working, accuracy in machining, surface finish, tool selection and other machining parameters.

UNIT V

ELECTRON BEAM MACHINING: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations.

LASER BEAM MACHINING: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand and its the applications of electron beam and laser beam in manufacturing environment, accuracy, machining speed and etc, with respect to all non-traditional machining processes.

TEXT BOOKS:

1. Advanced machining processes, VK Jain, Allied publishers.,2016
2. Modern Machining Process , Pandey P.C. and Shah H.s., TM,012
3. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R

REFERENCE BOOKS:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 2002

2. Manufacturing processes for engineering by Ronen Bergman.

3.Modern Manufacturing Processes , Kaushik Kumar Paulo Davim, 22nd May 2012.

Course Title	COMPOSITE AND NANO MATERIALS				B. Tech. ME VIII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1803803	**PE**	**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:

1.To understand the concept of The Variety of composite materials(Anisotropic materials) vise versa

2. To understand the Essential Requirements of Good Matrix Material from the view point of Industrial Application

3. To understand the concepts of Concretes ,Various types of ceramic composite Materials

4. Understanding the concept of verity Methods of Fabrication processes for Economic Production

5. To understand the Characteristics, Properties and Applications of Modern Materials

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

CO 1	understand the importance and its Role of interface in Composite Materials
CO 2	Analyze the basic concepts of the Essential Requirements of Good Matrix Material
CO 3	knowledge about Various types of ceramic composite Materials, and Hybrid composites
CO 4	Select the proper Fabrication methods of Glasses
CO5	Evaluate different Characteristics, Properties and Applications of Modern Materials

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 materials 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

CERAMIC COMPOSITE MATERIALS (Concretes): Charectestics, Various types of ceramic composite materials
Portland Cement concrete (PCC), Reinforced cement concrete (RCC)
Pre-stressed concrete (PC), Post tensioning in Cement 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
GLASSESS:
Types of Glasses ,Fabrication of glass by Blowing –Flat Drawing-Rolling Pressing in to moulds-Casting, Spinning –Crystalline Ceramics

UNIT-V

MODERN MATERIALS: Advanced to Nano Phase materials, Charactestics, Properties and applications
Shape memory alloys- Properties and applications
Smart materials alloys- Properties and applications
Advanced Ceramics : Cermets- Properties and applications

Textbooks:

1. Mathews F.L; and Rawlings R.D; Composite materials; Engineering and science, Chapman and Hall, London, England, Ist edition,2014.
2. Chawla K. K; Composite materials, Springer.Verlag,
3. Materials science & Engineering, Shashi Chawla,2002

Reference Books:

1. Clyne T.W, and Withers P, I, Introduction to Metal Matrix Composites, Cambridge University press,
2. Strong A.B, Fundamentals of composite Manufacturing, SME,.
3. Sharma S.C, Composite materials, Narosa Publications,2000

Course Title	Introduction to Expert systems				B. Tech. ME VIII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1803804	PEC	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	0	30	70	100
INTERNAL Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

The course objectives include:

- To develop informed opinions about the present and past opinion leaders in the artificial intelligence debate.

- To develop a simple, informal expert system by performing an effort of knowledge engineering of a real, human expert.

- To develop a series of Web pages that will serve as a current "state of the art" review of the various AI application areas, areas which may be suggested by the instructor or brought to the course by participants.

- To experience some actual hands-on demonstration software while accomplishing the review of current applications areas in AI. Examples of such areas might include natural language processing (NLP), genetic algorithms or artificial life environments , neural nets or massively parallel computing environments, data mining, fuzzy logic, machine vision or speech, robotics, intelligent tutoring systems, etc.

Unit-I

Artificial Intelligence: Introduction, definition, underlying assumption, Important of Al, Al & related fields State space representation, defining a problem, production systems and its characteristic, search and control strategies –Introduction, preliminary concepts, examples of Search.

Unit-II

Uniformed or preliminary Concept: Examples of search problems, Uniformed or Blind Search, Informed Search, Or Graphs, Heuristic Search techniques- Generate and Test, Hill climbing, best first search, Problem reduction, Constraint satisfaction, Means-.

Unit III

Knowledge Representation Issues: Representations and Mapping, Approaches, Issues in Kr, Types of knowledge procedural Vs Declarative, Logic programming, Forward Vs Backward reasoning, Matching, Non monotonic reasoning and it logic. Use of Predicate Logic: Representing simple facts, Instance and is a relationships, Syntax and Semantics for Propositional logic, conversion to casual form, Resolution, Natural deduction

Unit-IV

Statistical and Probabilistic Reasoning: Symbolic reasoning under uncertainly, Probability and Bayes theorem, Certainty factors and Rule based systems, , Dempster- Shafer Theory, Fuzzy Logic Expert Systems: Introduction, Structure and uses, Representing and using domain knowledge, Expert System Shells. Pattern recognition, introduction, Recognition and classification process, learning classification patterns, recognizing and understanding speech

Unit-V

Introduction to Knowledge Acquisition: Types of learning, General learning model, and performance measures. Introduction to Machine Learning: Perceptions, Checker Playing examples, Learning, Automata, Genetic Algorithms, Intelligent Editors.

TEXT BOOKS

1. " Artificial Intelligence" , Elaine Rich & Kevin Knight,M/H 2013

2. "Artificial Intelligence in Business", Wendry B.Ranch, Science & Industry –Vol –II application, 2005.

3. " A Guide to Expert System" Waterman, D.A., Addison,– Wesley inc. 2006.

REFERENCE BOOKS

1. "Building expert system" Hayes, Roth, Waterman, D.A (ed), AW 2013.

2. "Designing Expert System", S.M. and Kulliknowske. Stuart Russell

3. A Modern approach to Artificial Intelligence by Stuart Russell.

Course Title	Computer Aided Process Planning				B. Tech. ME VIII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1803805	PCC	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
INTERNAL Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course objectives:

The objective of this subject is

part programming.

1. To understand the concept of process planning and various methods of process planning using computer

2. To understand the geometric model of the component in CAD technology of computer graphics in order to describe part features for process planning.

3. To understand the Steps involved in variant type computer aided process planning and generative type computer aided process planning.

4. Understanding the concept of Group technology to implement variant type computer aided process planning.

5. To understand the principle of NC, CNC, Machining Centre and various methods of part **programming**

Unit I Introduction to process planning, Information required for process planning system, Steps in process planning, Route sheet, Manual approach, Computer aided process planning: Retrieval CAPP system, Generative CAPP system, Hybrid approach, CAPP applications, Facts about CAPP technology, Criteria for selecting a CAPP system, Benefits of CAPP and Limitations of CAPP

Unit II: Introduction to group technology, Benefits of group technology, Part family, Methods of grouping the parts into part family: The visual inspection method, Part classification and coding system, MICLASS classification and coding system, Opitz classification system, Production flow analysis , Composite part, Limitations of group technology, Application of group technology in CAPP, Retrieval CAPP system:

Unit – III Generative CAPP system: Principle of Generative CAPP system, Essential elements in a generative CAPP system, Implementation of generative CAPP systems, Advantages, Disadvantages and Applications Selection of manufacturing sequence: Identifying machinable volumes or pockets required in machining process, Setup planning, Attaching pockets to setups, Determining holding method, Alternative sequences,

Unit –IV

Manufacturing possesses for metals, Machining process, cutting parameters, Different approaches for solving speed/feed selection problem, Elements of cost in manufacturing operation, Optimization model to predict the optimum speed, Breakeven analysis in selection of process. Computerized packages for layout analysis: Travel charts, Relationship charts,

Unit –V

Determination of manufacturing tolerances: Design tolerances, Manufacturing tolerances, Need of tolerances in design and manufacturing, Tolerance allocation ,Tolerance analysis models for assemblies: Worst case, Statistical, Tolerance allocation methods: Allocation by proportional scaling, Allocation by constant precision factor,

Text Books:

1. Automation, Production systems and Computer Integrated Manufacturing System ,Mikell P.Groover,2014

2. Computer Aided Design and Manufacturing, Dr.Sadhu Singh.2009

3. Computer Aided Engineering, David Bedworth,2005

References:

1.computer aided process planning, vol.13 by h.p wang, 2018 edition

2. computer aided process planning By Saranga Pande.

3.Computer Aided Inspection Planning Theory And Practice By Abdul Rehman , 2017 Edition

Course Title	RELIABILITY IN ENGINEERING				B. Tech. VIII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803806	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	--	-	3	30	70	100
MID EXAMINATIONS DURATION :2Hrs					END EXAMINATION DURATION : 3Hrs			

CourseObjectives:

- To introduce the basic concepts of reliability, various models of reliability
- To analyze reliability of various systems
- To introduce techniques off frequency and duration for reliability evaluation of repairable systems

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

CO 1	Model various systems applying reliability networks
CO 2	Evaluate the reliability of simple and complex systems
CO 3	Estimate the limiting state probabilities of repairable systems
CO 4	Apply various mathematical models for evaluating reliability of irreparable systems

UNIT-I

BasicProbabilityTheory:Elementsofprobability,probabilitydistributions,Randomvariables,DensityandDistributionfunctions-Mathematicalexpected–varianceand standard deviation

BinomialDistribution: Concepts,properties,engineeringapplications.

UNIT-II

Network Modeling and Evaluation of Simple Systems: Basic concepts- Evaluation of networkReliability/Unreliability-Seriessystems,Parallelsystems-Series-Parallelsystems-Partiallyredundantsystems-Examples.

NetworkModelingandEvaluationofComplexSystems

Conditionalprobabilitymethod-tieset,Cut-setapproach-Eventtreeandreducedeventtreemethods-Relationshipsbetween tie and cut-sets-Examples.

UNIT-III

ProbabilityDistributionsInReliabilityEvaluation:Distributionconcepts,Terminology ofdistributions, General reliability functions, Evaluation of the reliability functions, shape of reliabilityfunctions–Poissondistribution–normaldistribution,exponentialdistribution,Weibulldistribution.

Network Reliability Evaluation Using Probability Distributions: Reliability Evaluation of Seriessystems, Parallel systems – Partially redundant systems- determination of reliability measure-MTTFforseriesand parallelsystems– Examples.

UNIT-IV

Discrete Markov Chains: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation-Absorbing states–Application.

ContinuousMarkovProcesses:Modelingconcepts-Statespacediagrams-Unreliabilityevaluationofsingleand two component repairable systems

UNIT-V

Frequency and Duration Techniques: Frequency and duration concepts, application to multi state problems, Frequency balance approach.

Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cutsetapproach-Common mode failures modeling and evaluation techniques-Examples.

Textbooks:

1. Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press, Edition 2006
2. E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited Edition 2010
3. Reliability Engineering, Singiresu S. Rao, Pearson Publishers, Edition 2016

REFERENCES:

1. Reliability and Maintainability Engineering, Charles E. Ebeling, McGrawhill Publishers, Edition 2017
2. Reliability Engineering: Theory and Practice by Alessandro Birolini, SpringerPublications.Edition 2017
3. Performance and modeling and manufacturing systems by NARAHARI, IIT Professor, 2018.

Course Title	Total Quality Management				B. Tech. ME VIII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803807	OEC-IV	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

COURSE OBJECTIVES:

On completion of this course, the students are expected to acquire the knowledge of Total Quality Management.

1. To impart knowledge about the total quality management principles
2. To demonstrate the importance of statistical process control for process monitoring
3. To familiarize with the concepts of TQM techniques and quality management systems.

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

CO 1	Develop action plans for customer centric business on the basis of various quality philosophies.
CO 2	Apply total quality management techniques for design and manufacture of highly reliable products and services.
CO 3	Develop statistical process control charts for monitoring the health of manufacturing systems.
CO 4	Solve various industrial problems using Six Sigma and related techniques.
CO5	Establish quality management system and environmental management system for product and service industries.

UNIT-I

Introduction: The concept of TQM, Quality and Business Performance, Attitude and Involvement of Top Management, Communication, Culture and Management Systems. Management of Process Quality: Definition of Quality, Quality Control, a Brief History, Product Inspection Vs Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT-II

Customer Focus and Satisfaction: Process Vs Customer, Internal Customer Conflict, Quality Focus, Customer Satisfaction, Role of Marketing and Sales, Buyer – Supplier Relationships. Bench Marking: Evolution of Bench Marking, Meaning of Bench Marking, Benefits of Bench Marketing, the Bench Marking Procedure, Pitfalls of Bench Marketing.

UNIT-III

Organizing for TQM: The Systems Approach, Organizing for Quality Implementation, Making the Transition from a Traditional to a TQM Organization, Quality Circles, Seven Tools of TQM: Stratification, Check Sheet, Scatter Diagram, Ishikawa Diagram, Pareto Diagram, Kepner and Tregoe Methodology.

UNIT-IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

UNIT-V

ISO9000: Universal Standards of Quality: ISO Around the World, The ISO9000 ANSI/ASQC Q-90, Series Standards, Benefits of ISO9000 Certification the Third Party Audit, Documentation ISO9000 and Services, the Cost of Certification Implementing the System.

TEXT BOOKS :

1. Total Quality Management / Joel E. Ross/Taylor and Franscis Limited, 2012
2. Total Quality Management/P. N. Mukherjee/PHI, 2010
3. Quality Management/Kanishka Bedi/Oxford University Press/2011

REFERENCES:

1. Beyond TQM / Robert L.Flood,2007
2. Statistical Quality Control / E.L. Grant.2012
3. Total Quality Management:A Practical Approach/H. Lal

Course Title	Introduction to IC engines				B. Tech. ME VIII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803808	OEC-IV	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

COURSE OBJECTIVES:

On completion of this course, the students are expected to Acquire the knowledge of engine components and fuel air cycles.

1. Understand the working of engine auxiliary systems.
2. Understand the combustion aspects of SI Engines
3. Understand the combustion aspects of CI Engines.
4. Know the various alternate fuels, engine emissions, measuring and control techniques

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

CO 1	understand the fundamental principles of IC engines
CO 2	understand the operation of IC Engines, auxiliary systems, combustion of SI & CI engines, various fuels used and engine emissions
CO 3	understand the performance of IC Engines, auxiliary systems,
CO 4	understand the combustion of SI & CI engines,
CO5	understand the various fuels used and engine emissions

MAPPING OF PO AND CO

Influence of the course outcome (1-Low, 2-Medium, 3- High)

Influence of the course outcome (1-Low, 2-Medium, 3- High)

Unit I

COMPONENTS OF IC ENGINES AND PERFORMANCE

Classification of Internal combustion Engine, Function and operation of Two stroke and Four stroke engines, Comparison of SI and CI and two stroke and four stroke engines, Effects of supercharging and supercharging Types - centrifugal, roots, vane, Types of scavenging process, Design and Performance data, Efficiency, Specific fuel consumption, IMEP determination - Simple calculations - Performance characteristics, Heat balance calculations, Fuel air cycles and their significance, Comparison of air-standard and fuel air cycles

UNIT II

ENGINE AUXILIARY SYSTEMS

Desirable air- fuel ratios for starting, warm up, acceleration, idling and normal operation, Necessity of Carburetors and their function and types, Function and classification of injection systems, Injection pump, governor and nozzle types, Description of construction and function of Electronic injection system and MPFI systems, Energy requirement of ignition system, need, Types - Battery and Magneto ignition types, Ignition timing and engine parameters, Engine oil properties, lubrication system types - mist, wet sump and dry sump lubrication systems, Types of cooling systems - Direct and Indirect - Coolant and antifreeze solutions.

UNIT III

COMBUSTION IN SI ENGINES

Homogeneous and heterogeneous mixture, Combustion in spark ignition engines, Stages of combustion in spark ignition engines, Flame front propagation, Factors influencing flame speed, Rate of pressure rise, Phenomenon of knock in SI engines, Effect of engine variables on knock, Combustion chambers for SI engines - Smooth engine operation, High power output and thermal efficiency, Stratified charge engine.

Unit –IV

COMBUSTION IN CI ENGINES

Combustion in CI engine, Stages of combustion in CI engines, Factors affecting the delay period - compression ratio, engine speed, output, atomization and duration of injection, quality of fuel, intake temperature, intake pressure, Phenomenon of knock in CI engines, Comparison of knock in SI and CI engines, Air motion - Swirl - Squish.

Unit –V

ALTERNATE FUELS AND EMISSION

Alternate Fuels -Alcohol, Methanol, Ethanol, Gaseous fuel - Hydrogen, CNG, LPG, and Biodiesel - production, advantages & disadvantages. Air pollution due to IC engines, Hydrocarbon emission and their reasons, Formation of oxides of nitrogen, CO, Particulates, aldehydes, sulphur, lead and phosphorus emissions, catalytic converter, exhaust gas recirculation, Flame ionization detector, NDIR, smoke types - measuring device. Emission standards

TEXT BOOKS : 1. Ganesan.V, "Internal Combustion Engines", Tata McGraw-Hill, New Delhi,2019,4 th edition

2.Ramalingam.K.K, "Internal Combustion Engines- Theory and practice",SciTech publications India Pvt. Ltd., Chennai, 2010.

3. Thipse.S.S, "Internal Combustion Engines", Jaico Publication House., 2010.

REFERENCES

1. Mathur.M.L and Sharma.R.P, "A course in Internal Combustion Engines", Dhanpat Rai & Sons, New Delhi, 2010.
2. Heywood.J.B, "Internal Combustion Engine Fundamentals", McGraw Hill International, New York, 2008.
3. Domkundwar.V.M, "A course in Internal Combustion Engines", Dhanpat Rai & Sons, 2010.

<table>
<tr><td>Course Title</td><td colspan="5">MAJOR PROJECT</td><td colspan="3">B. Tech. VII Semester</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">1803813</td><td rowspan="2">PROJ</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>--</td><td>--</td><td>12</td><td>5</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="9">Course Objective: The objective of the project is to enable the student to take up investigative study in the field of Mechanical engineering.</td></tr>
<tr><td colspan="9">On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand core concepts and research findings relative to human development, socialization, group dynamics and life course processes.</td></tr>
<tr><td>CO 2</td><td colspan="8">Identify and transfer existing ideas into new contexts and applications</td></tr>
<tr><td>CO 3</td><td colspan="8">Apply and transfer academic knowledge into the real-world</td></tr>
<tr><td>CO 4</td><td colspan="8">Design a component or a product applying all the relevant standards and with realistic constraints</td></tr>
<tr><td></td><td colspan="8"></td></tr>
</table>

The following are the rules and regulation for Mechanical Relevant Projects:

11. The student has to spend 30Hrs in the semester on any relevant project and submit a report for evaluation.
12. The project is evaluated for 50 marks in the semester by a committee consisting of head of the department, project mentor and one senior faculty member of the department.
13. A student shall acquire 5 credits assigned, when he/she secures 50% or more marks from the total of 100 marks.
14. In case, if a student fails, he/she shall resubmit the report.
15. The External evaluationis for 50 marks.

Course Title	SEMINAR-II					B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803814	PROJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		--	--	1	1	100	0	100
Course Objective: The objective of the seminar II is to enable the student to take up investigative study in the field of Mechanical engineering.								
On successful completion of this course, the students will be able to								
CO 1	. Students will learn to survey the relevant literature such as books, national/international refereed journals and contact Faculty for the selected topic of seminar.							
CO 2	Students will be able to use different experimental techniques.							
CO 3	Students will learn to write technical reports.							
CO 4	Students will develop skills to present and defend their Report in front of audience.							

The following are the rules and regulation for Mechanical seminar II:

- **Syllabus Contents:**

  Students can take up topic in the field of mechanical engineering as seminar Topic.. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc. The Seminar Topic Must present in presence of Concerned Faculty and co students.

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