ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

MECHANICAL ENGINEERING

B.Tech - Four Year Degree Course

(Applicable for the Batches Admitted from 2016-2017)

R-16

(Choice Based Credit System)

NEC

NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

Kotappakonda Road, Yellamanda (P),
Narasaraopet - 522 601, Guntur Dist.,
Andhra Pradesh, INDIA.

Academic Regulations, Course Structure and Syllabus

B. TECH.
Mechanical Engineering
(4 Year Program)

NARASARAOPETA
ENGINEERING COLLEGE
(Autonomous)

Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.
Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada. Code: 47.
Accredited by NBA & NAAC with "A" Grade; ISO 9001:2008 Certified Institution.
Phone: 08647239905 Website: www.nrtec.ac.in

ACADEMIC REGULATIONS - 2016 FOR B.Tech (REGULAR)

(Applicable for the students of B.Tech from the Academic Year 2016-17)

1. ELIGIBILITY FOR ADMISSION

The total seats available as per the approved intake are grouped into two categories viz. category A and Category B with a ratio of 70:30 as per the state government guidelines vide G.O No.52

a. The admissions for category A and B seats shall be as per the guidelines of Andhra Pradesh State Council for Higher Education (APSCHE) in consonance with government reservation policy.

   ϖ Under Category A: 70% of the seats are filled through EAMCET counselling.

   ϖ Under Category B: 30% seats are filled based on 10+2 merits in compliance with guidelines of APSCHE

b. Admission eligibility-Under Lateral Entry Scheme

   Students with diploma qualification have an option of direct admission into 2nd year B.Tech. (Lateral Entry scheme). Under this scheme, 20% seats of sanctioned intake will be available in each course as supernumerary seats. Admissions to this three year B.Tech later entry Programme will be through ECET. The maximum period to complete B.Tech. under Lateral Entry scheme is six consecutive academic years from the date of joining.

The selection for category A & B seats shall be as per Govt. of Andhra Pradesh rules.

2. AWARD OF B.TECH. DEGREE

A student will be declared eligible for the award of the B.Tech. Degree if he fulfils the following academic requirements.

(a) Pursue a course of study for not less than four academic years and not more than eight academic years counted from the academic year of admission.

(b) The student registers for 180 credits and secures all the 180 credits.

3. COURSES OF STUDY

The following UG- B.Tech Programs are offered at present

S. No.	Branch Code-Abbreviation	Branch
01	01-CE	Civil Engineering
02	02-EEE	Electrical and Electronics Engineering
03	03-ME	Mechanical Engineering
04	04-ECE	Electronics and Communication Engineering
05	05-CSE	Computer Science and Engineering

And any other course as approved by the authorities from time to time.

4. STRUCTURE OF THE PROGRAM

Program comprises of 4 academic years and each year has 2 semesters. Each course is normally assigned a certain number of credits as follows:

¬ 3 credits for 3 lecture periods and 1 tutorial per week.

¬ 3 credits for 4 lecture periods per week

¬ 2 credits for 3 laboratory periods per week.

¬ 3 credits for 1 lecture and 4 practice periods for drawing subjects per week.

¬ 1 or 2 credits for Mini Project.

¬ 3 credits for Practical Training/ Internship.

¬ 10 credits for Project Work.

5. DISTRIBUTION AND WEIGHTAGE OF MARKS

The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks for Theory, Practical Training / Internship and 75 marks for Practical's / Mini Project. The Project Work shall be evaluated for 200 marks.

5.1 THEORY

For all theory subjects consisting of 6 units in each subject, the assessment shall be for 40 marks through internal evaluation and 60 marks through external end semester examination of 3 hours duration.

5.1.a. INTERNAL EVALUATION

The internal evaluation will be based on two cycle tests conducted in each semester. The 40 internal marks will be awarded as sum of 75% of the best cycle and 25% of the least cycle examinations, where each cycle of examination contain

Descriptive test - 20 Marks
Objective test - 10 Marks
Assignment test -10 Marks

Each descriptive test question paper contains 3 questions one from each unit covering syllabus from 3 units (first 3 units for first cycle and remaining 3 units for second cycle). The student has to answer all the 3 questions (3X10M=30M). The 30 marks will be scaled down to 20 marks. The descriptive examination will be conducted for 1½ hour duration.

Online Objective type test question paper shall contain 20 objective questions for 10marks covering syllabus from 3 units, which are considered for descriptive type test (20 X 1/2 M = 10M). The Objective Examination will be conducted for 20 minutes duration along with descriptive test.

In Assignment Tests, 5 or 6 questions will be declared in the class room at least one week in advance. In the test, one question will be given at random to each student and the student has to answer it.

The Assignment Test-1 will be conducted for 10 marks covering the syllabus of 1^{st} unit. The Assignment Test-2 will be conducted for 10 marks covering the syllabus of 2^{nd} unit. The internal marks for Assignment Test (10 Marks) for cycle-I shall be computed as best of two Assignment Tests-1 & 2 conducted. The Assignment Test-3 will be conducted for 10 marks covering the syllabus of 4^{th} unit. The Assignment Test-4 will be conducted for 10 marks covering the syllabus of 5^{th} unit. The internal marks for Assignment Test (10 Marks) for cycle-II shall be computed as best of two Assignment Tests-3 & 4 conducted.

5.1. b. EXTERNAL EVALUATION

The question paper comprises of two parts i.e. Part-A and Part-B. Part-A is compulsory and consists of six 2 marks questions covering all units. Part A is total 12 marks. Part-B consists of 6 questions, one from each unit and the student has to answer any four questions, and each question carries 12 marks. The examination duration is 3 hours.

5.2 PRACTICALS

For practical subjects there shall be continuous evaluation during the semester.

5.2. a. INTERNAL EVALUATION

There shall be continuous evaluation during the semester for 25 internal marks. The internal marks shall be awarded as follows:
Record - 10 Marks
Internal Lab Test - 10 Marks Day to day performance - 5 Marks

5.2. b. EXTERNAL EVALUATION

For practical subjects there shall be an external examination at the end of the semester for 50 marks in the presence of external examiner. The examination duration is 3 hours.

5.3 DRAWING SUBJECTS

- For the subject having design or drawing (such as Engineering Graphics, Engineering Drawing, Machine Drawing etc.,), the distribution shall be 40 marks for Internal Evaluation and 60 marks for End Examination.

The 40 internal marks will be evaluated as follows: Internal Tests - 20 marks. (1½ hour duration)
Day to day work - 20 marks (evaluation of drawing sheets)
In the internal test, 3 questions will be given to the student and he has to answer all the three questions (3x10M = 30M scaled down to 20 marks)
There shall be two internal tests in a semester. The sum of 75% of the best and 25% of the least of two internal tests shall be considered for the award of internal marks.

- The syllabus for the subject "**Machine drawing using Auto CAD**" consists of two major portions:
  - Unit I to III –Conventional drawing pattern.
  - Unit IV to VI-Computer lab pattern using any drafting package

The distribution of internal and external marks is 40 and 60 marks respectively.

Internal Evaluation: Max Marks: 40
The total internal evaluation marks are distributed in the following two components:

- Day-to-day work : 20 Marks (Evaluation of Charts)
- Descriptive Test : 20 Marks

Cycle–I Examination – Conventional drawing pattern
In Cycle-I examination the 40 marks will be awarded as follows: Day-to-day evaluation - 20 Marks
Descriptive Test - 20 Marks
In the Descriptive Test of duration 2 hours, 3 questions will be given to the student and he has to answer all the three questions (3x10M = 30M scaled down to 20 marks).

Cycle–II Examination – Computer lab pattern using any drafting package for duration of 2 hours.
In Cycle-II examination the 40 marks will be awarded as follows: Record -10 Marks
Execution -15 Marks
Paper Work -15 Marks

Of two cycle examinations conducted during the semester, sum of 75% of the best and 25% of the least of two cycle examinations shall be considered for the award of internal marks.

End semester Examination (Total Duration: 4 hours, Max. Marks: 60) Conventional drawing pattern (Duration: 2 Hours, Marks: 30)
Computer lab pattern using any drafting packages (Duration: 2 Hours, Max: 30)
(Note: Both Conventional drawing pattern and Computer lab pattern using any drafting packages are compulsory and are to be conducted in separate sessions)

5.4 MANDATORY NON-CREDIT COURSES

A student is required to take up Non-Credit/mandatory courses, viz. Advanced Communication Skills, Quantitative Aptitude, Verbal Ability, Reasoning, NSS / Sports & Games and MOOCs (Massive Open Online Courses) etc., as and when the courses are offered. The B.Tech degree shall only be awarded if a student gets satisfactory grade in each of the mandatory non-credit courses besides acquiring 180 credits.
A student has to repeat the course if he does not get satisfactory grade in each non- Credit course for getting the degree awarded.

NSS:

There shall be internal valuation for 100 Marks, out of which 60 marks are for participation and involvement in day-to-day activities and 40 marks for participation and involvement in a three days NSS camp arranged during the semester.

Sports and Games / Creative Arts:

There shall be two internal valuations, each for 50 marks, in the chosen activity, one in the middle of semester and the other towards the end of the semester. Sum of the two valuations shall be taken as the final marks for 100.

MOOCs: Meeting with the global requirements, to inculcate the habit of self-learning and in compliance with UGC guidelines, MOOCs (Massive Open Online Courses) have been introduced. Student has to complete an on-line course to fulfil the academic requirement of B.Tech course. The on-line Course should be offered by any reputed organization like NPTEL, COURSERA, edX, Udacity, SWAYAM etc., approved by the departmental Committee constituted by HOD. Student has to submit the progress of the MOOC's course (such as assignment submission etc.,) to the departmental committee. B.Tech. degree shall be awarded only upon submission of MOOC's certificate. If a student fails to submit in that semester, he/she has to submit the certificate in the subsequent semesters for getting the degree awarded.

5.5. PRACTICAL TRAINING / INTERNSHIP

Students are advised to take up Industrial Internship. In case, the student is unable to obtain the internship, they can opt for Practical Training.

Assessment for Internship:

Industrial Internship which is a part of the curriculum shall carry 100 marks. The time duration for internship shall be of 2 to 4 weeks during the inter semester break. After the completion of internship the student shall submit a certificate and a report to the concerned departmental committee constituted by the HOD for Evaluation and to conduct a Viva- Voce Examination. Out of 100 marks, 40 marks shall be awarded for submission of certificate and report and 60 marks for presentation and Viva-Voce examination.

Assessment for Practical Training:

The practical training gained by student shall be assessed for 100 marks. The time duration for Practical Training shall be 2 to 4 weeks during the inter semester break. The training shall be evaluated through continuous assessment. After the completion of Practical Training the student shall submit a report to the Departmental Committee constituted by HOD for evaluation and to conduct a Viva-Voce Examination. Out of 100 marks 40 marks shall be awarded for day to day performance and submission of report and 60 marks for presentation and Viva-Voce examination.

5.6 MINI PROJECT

Mini Project shall be evaluated for a total of 75 marks. Out of a total of 75 marks, 25 marks shall be for internal evaluation consisting of day-to-day work, reviews, the assessment of the project report and 50 marks for the external evaluation. The external evaluation shall be conducted by the committee. The committee consists of an External Examiner, Head of the Department and Supervisor of the Project. The evaluation of mini project work shall be conducted as and when offered.

5.7 PROJECT WORK

Out of a total of 200 marks for the project work, 80 marks shall be for Internal Evaluation consisting of day-to-day work, reviews, the assessment of the project report and 120 marks for the external evaluation. The external evaluation shall be conducted by the committee. The committee consists of an External Examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the IV year II semester.

6. PASS MARK CRITERIA

A student shall be deemed to have satisfied the pass mark, if he secures not less than 35% of marks in the end examinations and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together as detailed below.
On passing a course of a program, the student shall earn the credits as assigned to that Course.

S. No.	Category of Subject	Max. Marks	Internal Marks	External Marks	External pass %	External pass mark	Over all pass %	Over all pass mark
1	Theory/Drawing / Practical Training/ Internship	100	40	60	35	21	40	40
2	Practical	75	25	50	35	18	40	30
3	Mini Project	75	25	50	35	18	40	30
4	Project work	200	80	120	35	42	40	80

7. PROMOTION POLICY

7.1. ATTENDANCE REQUIREMENTS

(1) A student shall be eligible to appear for the end examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

(2) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester for genuine medical reasons and shall be approved by a committee duly appointed by the college. A fee stipulated by the college shall be payable towards condonation of shortage of attendance. However the number of condonations is restricted to four for the entire course.

(3) A student who is short of attendance in a semester may seek re-admission into that semester when offered next time within 4 weeks from the date of commencement of class work.

(4) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for re-admission into the same semester.

7.2. CREDIT REQUIREMENTS

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned above.

(1) A student shall be promoted from I to II year, if he put up the minimum attendance requirement in I year II semester, irrespective of credits earned.

(2) A student shall be promoted from II year to III year, only if he fulfils the academic requirement of 50% of the credits up to II year II semester from all the examinations, irrespective of whether the candidate takes the examination or not.

(3) A student shall be promoted from III to IV year, only if he fulfils the academic requirements of 50% of the credits up to III year II semester from all the examinations, irrespective of whether the candidate takes the examination or not.

(4) A candidate, who is not promoted either to III year or IV year due to lack of required credits can seek admission into III / IV year in subsequent years after obtaining the required credits as stipulated above.

(5) A student shall register and put up minimum attendance in all 180 credits and earn all 180 credits. Marks obtained in the all 180 credits shall be considered for the calculation of grade points/division.

(6) The registrations in audit courses/ mandatory courses i.e. Advanced Communication skills, Aptitude, Verbal Ability, Quantitative Aptitude and Reasoning, NSS / Sports & Games and MOOCs etc., is compulsory and student should get a satisfactory report.

8. COURSE PATTERN

(1) The entire course of study is of four academic years and each year will have TWO Semesters (Total EIGHT Semesters).

(2) Supplementary Examinations: A student is eligible to appear for the end examination in a subject, but absent for it or has failed in the end examinations may appear for that subject in supplementary examinations, when conducted next.

(3) Advanced supplementary Examinations: Students who failed in courses of 4th B.Tech. 2nd Semester can appear for advanced supplementary examination conducted within one month after declaration of the revaluation results. However, those students who failed in these advanced supplementary examinations shall appear for subsequent examinations along with regular candidates in the examinations conducted at the end of the respective semester.

(4) When a student is detained due to lack of credits / shortage of attendance, he may be re-admitted in to the same semester / year in which he has been detained.

9. METHOD FOR AWARDING OF GRADE POINTS FOR A SUBJECT:

Theory/ Drawing / Laboratory / Practical Training / Internship / Mini Project / Project (% of marks in a subject)	Corresponding Grade Points	Letter Grade
91 - 100	10	O (Outstanding)
81 - 90	9	E (Excellent)
71 - 80	8	A (Very Good)
61 - 70	7	B (Good)
51 - 60	6	C (Satisfactory)
40 - 50	5	P (Pass)
<40	0	F (Fail)

10. CRITERIA FOR AWARD OF GRADES/DIVISION

10.1 Calculation of Semester Grade Point Average (SGPA)* for semester

The performance of each student at the end of each semester is indicated in terms of SGPA. The SGPA is calculated as given below:

$$SGPA = \frac{\sum (CR \times GP)}{\sum CR}$$

Where,
CR = Credits of a subject
GP = Grade Points awarded for a subject
*SGPA is calculated for a student who passed all the subjects in that semester.

10.2 Calculation of Cumulative Grade Point Average (CGPA)* for Entire Program:

The CGPA is calculated as given below:

$$CGPA = \frac{\sum (CR \times GP)}{\sum CR}$$

Where,
CR= Credits of a subject
GP = Grade Points awarded for a subject
*CGPA is calculated for a student who passed all the subjects in previous semesters along with current semester.

- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- Equivalent percentage = (CGPA – 0.75) x 10

10.3 Award of Division:

After satisfying the requirements prescribed for the completion of the program, the student shall be eligible for the award of B.Tech Degree and shall be placed in one of the following classes:

CGPA	Class
≥ 7.75	Degree with First Class with Distinction (with no subject failures)
≥ 6.75	Degree with First Class (with subject failures)
≥ 5.75 & < 6.75	Degree with Second Class
< 5.75	Degree with Pass Class

11. REVALUATION

1. Student can submit the application for revaluation, along with the prescribed fee for revaluation of his answer script(s) of theory subject(s) as per the notification issued by the Controller of Examinations.
2. The Controller of Examinations shall arrange for revaluation of such answer script(s).
3. An External examiner, other than the first examiner shall reevaluate the answer script(s).

12. MINIMUM INSTRUCTION DAYS

The minimum instruction days for each semester shall be 90 working days.

13. There shall be no branch transfer after the completion of admission process.

14. WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the college or if any case of indiscipline is pending against him, the result of such student will be kept withheld. His degree will be withheld in such cases.

15. TRANSITORY REGULATIONS

Discontinued or detained candidates are eligible for readmission as and when next offered. A candidate, who is detained or discontinued in a semester, on readmission shall be required to do all the subjects in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such subjects in the earlier semester(s) he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

15.1. A student who is following JNTUK curriculum and detained due to shortage of attendance at the end of the first semester of first year shall join the autonomous batch of first year first semester. Such students shall study all the subjects prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

15.2. A student who is following JNTUK curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of first year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree will be sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

15.3 Transfer candidates (from non-autonomous college affiliated to JNTUK)

A student who is following JNTUK curriculum, transferred from other college to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

15.4 Transfer candidates (from an autonomous college affiliated to JNTUK)

A student who has secured the required credits up to previous semester as per the regulations of other autonomous institutions shall also be permitted to be transferred to this college. A student who is transferred from the other autonomous colleges to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree.

However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of studies.

The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester as per the regulations of the college from which he has transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

Academic Regulations (16) for B. Tech. (Lateral Entry Scheme)

(Effective for the students getting admitted into II year from the Academic Year 2017- 18 and onwards)

1. AWARD OF B. TECH. DEGREE

A student will be declared eligible for the award of the B. Tech. Degree if he fulfils the following academic regulations.

(a) Pursue a course of study for not less than three academic years and not more than six academic years counted from the academic year of admission.

(b) The candidate registers for 132 credits and secures all the 132 credits.

2. The attendance regulations of B.Tech (Regular) shall be applicable to B.Tech (LES), whereas the number of condonations is restricted to 3.

3. PROMOTION RULE:

(a) Attendance requirement is same as regular course.

(b) A lateral entry student will be promoted from II to III year if he puts up the minimum required attendance in II year II semester irrespective of credits earned.

(c) A student shall be promoted from III to IV year only if he fulfils the academic requirements of 50% of the credits up to III Year II semester from all the examinations, whether the candidate takes the examinations or not.

4. TRANSITORY REGULATIONS:

4.1 A student who is following JNTUK curriculum and detained due to shortage of attendance at the end of the first semester of second year shall join the autonomous batch of second year first semester. Such students shall study all the subjects prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

4.2 A student who is following JNTUK curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the subjects of the semester(s) of the batch of them as decided by the Board of Studies.

The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

5. All the other regulations as applicable for B. Tech. Four- year degree course (Regular) will be applicable for B. Tech. (Lateral Entry Scheme).

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT INEXAMINATIONS

- The Principal shall refer the cases of Malpractices in Internal Assessment Test and Semester end examinations to a malpractice prevention committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the students based on the recommendations of the committee.
- Any action by the candidate trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder:

	Nature of Malpractices/ Improper conduct	**Punishment**
	If the candidate:	
1(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination).	Expulsion from the examination hall and cancellation of the performance in that subject only.
1(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the college.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and to be allowed to appear for examinations of the remaining subjects of that Semester/year.

		The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant– Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer- in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared

		Including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the college for further action to award suitable punishment.	

OTHER MATTERS:

1. Physically challenged candidates who have availed additional examination time and a scribe during their intermediate / EAMCET examinations will be given similar concessions on production of relevant proof / documents.
2. The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Heads of the departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the departments shall be reported to the Academic Council for ratification.

GENERAL:

1. The academic council may, from time to time, revise, amend or change the regulations, schemes of examinations and / or syllabi.
2. Where ever the words ‘’he’’ ‘’him’’ ‘’his’’, occur in the regulations, they include ‘’she’’, ’’her’’, ’’hers’’.
3. The academic regulation should be read as a whole for the purpose of any interpretation.
4. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the principal is final.

NARASARAOPETA ENGINEERING COLLEGE: NARASARAOPET
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech FOUR YEAR DEGREE COURSE STRUCTURE

I B.Tech I – SEMESTER COURSE STRUCTURE:

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Functional English	HS	4	-	-	40	60	100	3
2	Engineering Mathematics	BS	3	1	-	40	60	100	3
3	Mathematical Methods	BS	3	1	-	40	60	100	3
4	Engineering Chemistry	BS	4	-	-	40	60	100	3
5	Programming With C	ES	3	1	-	40	60	100	3
6	Professional Ethics, Values & Patents	HS	4	-	-	40	60	100	3
7	Basic Communication Skills Lab	HS	-	-	3	25	50	75	2
8	Engineering Chemistry Lab	BS	-	-	3	25	50	75	2
9	Computer Programming Lab	ES	-	-	3	25	50	75	2
	TOTAL		**21**	**3**	**9**	**315**	**510**	**825**	**24**

I B.Tech - II SEMESTER COURSE STRUCTURE:

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Interactive English	HS	4	-	-	40	60	100	3
2	Engineering Physics	BS	3	1	-	40	60	100	3
3	Integral Transforms & Vector Calculus	BS	3	1	-	40	60	100	3
4	Engineering Mechanics	ES	3	1	-	40	60	100	3
5	Engineering Drawing	ES	1	-	4	40	60	100	3
6	Environmental Studies	ES	4	-	-	40	60	100	3
7	Enhancing Communication Skills Lab	BS	-	-	3	25	50	75	2
8	Engineering Physics Lab	BS	-	-	3	25	50	75	2
9	Engineering Work Shop	ES	-	-	3	25	50	75	2
	TOTAL		**18**	**3**	**13**	**315**	**510**	**825**	**24**

II B.Tech - I SEMESTER COURSE STRUCTURE:

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Basic Electrical & Electronics Engineering	ES	3	1	-	40	60	100	3
2	Mechanics of Solids	ES	3	1	-	40	60	100	3
3	Material Science & Metallurgy	ES	4	-	-	40	60	100	3
4	Thermodynamics	PC	3	1	-	40	60	100	3
5	Fluid Mechanics	ES	3	1	-	40	60	100	3
6	Machine Drawing and CAD Lab	PC	1	-	4	40	60	100	3
7	BEE&E Lab	ES	-	-	3	25	50	75	2
8	Mechanics of Solids and Metallurgy Lab	PC	-	-	3	25	50	75	2
9	Verbal Ability (Mandatory Non Credit Course)	MDC	3	-	-	-	-	-	-
	TOTAL		**20**	**4**	**10**	**290**	**460**	**750**	**22**

II B.Tech - II SEMESTER COURSE STRUCTURE:

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Business Management Concepts for Engineers	HS	4	-	-	40	60	100	3
2	Theory of Machines	PC	3	1	-	40	60	100	3
3	Applied Thermodynamics	PC	3	1	-	40	60	100	3
4	Hydraulic Machinery & Pneumatic Systems	ES	3	1	-	40	60	100	3
5	Manufacturing Technology	PC	4	-	-	40	60	100	3
6	Applied Thermodynamics Lab	PC	-	-	3	25	50	75	2
7	Manufacturing Technology Lab	PC	-	-	3	25	50	75	2
8	FM&HM Lab	ES	-	-	3	25	50	75	2
9	Mini Project-I	PRC	-	-	-	25	50	75	1
10	Quantitative Aptitude And Reasoning	MDC	3	-	-	-	-	-	-
	TOTAL		**20**	**3**	**09**	**300**	**500**	**800**	**22**

III B.Tech - I SEMESTER COURSE STRUCTURE:

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Metal Cutting & Machine Tools	PC	4	-	-	40	60	100	3
2	Heat Power Engineering	PC	3	1	-	40	60	100	3
3	Machine Dynamics & Vibrations	PC	3	1	-	40	60	100	3
4	Principles of Machine Design	PC	3	1	-	40	60	100	3
5	Operations Research	BS	3	1	-	40	60	100	3
6	Open Elective-I (See the List of Open Electives)	OE	4	-	-	40	60	100	3
7	Heat Power Engineering Lab	PC	-	-	3	25	50	75	2
8	Machine Tools & Machine Dynamics Lab	PC	-	-	3	25	50	75	2
9	Advanced Communication Skills (Mandatory Non Credit Course)	MDC	3	-	-	-	-	-	-
10	Sports and Games (Mandatory Non Credit Course)	MDC	-	-	2	-	-	-	-
	TOTAL		**23**	**4**	**08**	**290**	**460**	**750**	**22**

III B.Tech - II SEMESTER COURSE STRUCTURE:

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Metrology & Instrumentation	PC	4	-	-	40	60	100	3
2	Design of Mechanical Components	PC	3	1	-	40	60	100	3
3	Heat Transfer	PC	3	1	-	40	60	100	3
4	Automobile Engineering	ES	4	-	-	40	60	100	3
5	**ELECTIVE-I**	PE							
	Gas Turbines and Jet Propulsion		3	1	-	40	60	100	3
	Fracture Mechanics								
	Jigs, Fixtures& Press Tool Design								
	Industrial Engineering and Cost Estimation								
6	Open Elective-II (See the List of Open Electives)	OE	4	-	-	40	60	100	3
7	Heat Transfer Lab	PC	-	-	3	25	50	75	2
8	Metrology & Instrumentation Lab	PC	-	-	3	25	50	75	2
9	Reasoning (Mandatory Non Credit Course)	MDC	3	-	-	-	-	-	-
	TOTAL		**24**	**3**	**6**	**290**	**460**	**750**	**22**

IV B.Tech - I SEMESTER COURSE STRUCTURE:

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Finite Element Methods	PC	3	1	-	40	60	100	3
2	CAD/CAM	PC	4	-	-	40	60	100	3
3	Advanced Manufacturing Processes	PC	4	-	-	40	60	100	3
4	Open Elective-III (See the List of Open Electives)	OE	4	-	-	40	60	100	3
5	**ELECTIVE-II**	PE							
	Power Plant Engineering		4	-	-	40	60	100	3
	Tribology and Bearing Design								
	Advanced Tool Design								
	Facility Layout and Material Handling								
6	**ELECTIVE-III**	PE	3	1	-	40	60	100	3
	Computational Fluid Dynamics								
	Rapid Prototyping								
	Advanced Mechanics of Solids								
	Production planning & Control								
7	CAD/CAM Lab	PC	-	-	3	25	50	75	2
8	Mini Project-II	PRC	-	-	-	25	50	75	2
9	NSS (Mandatory Non Credit Course)	MDC	-	-	2	-	-	-	-
	TOTAL		**22**	**2**	**5**	**290**	**460**	**750**	**22**

IV B.Tech - II SEMESTER COURSE STRUCTURE:

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Mechatronics	PC	4	-	-	40	60	100	3
1	**ELECTIVE-IV**	PE							
	Refrigeration & Air Conditioning		3	1	-	40	60	100	3
	Condition Monitoring								
	Powder Metallurgy								
	Quality and Reliability Engineering								
2	**ELECTIVE-V**	PE							
	Alternate Sources of Energy		4	-	-	40	60	100	3
	Experimental Stress Analysis								
	Geometric Modelling								
	Operations Planning and Control								
3	Project Work	PRC	-	-	-	80	120	200	10\
4	Practical Training/Intern Ship	PRC	-	-	-	40	60	100	03
	TOTAL		**11**	**1**	**-**	**240**	**360**	**600**	**22**

LIST OF OPEN ELECTIVES

Open Elective – I	Department Offering the Subject	No. of periods per week		No. of Credits
Subject Title		**L**	**T**	**C**
Elements of Mechanical Engineering (Other than ME)	ME	4	-	3
Material Science (Other than ME)	ME	4	-	3
Basic Electrical and Electronics Engineering (Other than EEE,ECE & ME)	EEE	4	-	3
Industrial Electronics (Other than EEE)	EEE	4	-	3
Principles of Signals, system & Communications (Other than ECE)	ECE	4	-	3
Automotive Electronics	ECE	4	-	3
Medical Electronics	ECE	4	-	3
Image Processing Algorithms and Analysis (Other than ECE)	ECE	4	-	3
Database Management Systems (Other than CSE & ECE)	CSE	4	-	3
Front End UI & Frame Work Tools (Other than CSE)	CSE	4	-	3
Principles of water quality management.	CE	4	-	3
Remote Sensing and GIS (other than CE).	CE	4	-	3

Open Elective – II	Department Offering the Subject	No. of periods per week		No. of Credits
Subject Title		**L**	**T**	**C**
Nanotechnology	ME	4	-	3
Work Study	ME	4	-	3
Fundamentals of Electrical Energy(Other than EEE)	EEE	4	-	3
Linear Control Theory (Other than EEE & ECE)	EEE	4	-	3
Introduction to Microprocessors and Micro Controllers (Other than ECE & EEE)	ECE	4	-	3
Consumer Electronics	ECE	4	-	3
Internet of Things (IOT) (Other than CSE)	CSE	4	-	3
Web Technologies (Other than CSE)	CSE	4	-	3
Cloud Computing (Other than ECE)	CSE	4	-	3
OOPS through JAVA (Other than CSE & ECE)	CSE	4	-	3
Disaster Management	CE	4	-	3
Building Services (Other than CE).	CE	4	-	3

Open Elective – III	Department Offering the Subject	No. of periods per week		No. of Credits
Subject Title		**L**	**T**	**C**
Operations Research (Other Than ME)	ME	4	-	3
Robotics	ME	4	-	3
Energy Audit, Conservation & Management (Other than EEE)	EEE	4	-	3
Non-Conventional Energy Resources (Other than EEE)	EEE	4	-	3
Introduction to embedded systems (Other than ECE)	ECE	4	-	3
Global Positioning System	ECE	4	-	3
Computer Networks (Other than CSE & ECE)	CSE	4	-	3
Web Animation and Interactivity Using Flash	CSE	4	-	3
Web Services	CSE	4	-	3
Water shed Management.	CE	4	-	3
Solid and Hazardous waste management (Other than CE).	CE	4	-	3

I B.TECH I SEMISTER

I B.Tech I – SEMESTER COURSE STRUCTURE

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Functional English	HS	4	-	-	40	60	100	3
2	Engineering Mathematics	BS	3	1	-	40	60	100	3
3	Mathematical Methods	BS	3	1	-	40	60	100	3
4	Engineering Chemistry	BS	4	-	-	40	60	100	3
5	Programming With C	ES	3	1	-	40	60	100	3
6	Professional Ethics, Values & Patents	HS	4	-	-	40	60	100	3
7	Basic Communication Skills Lab	HS	-	-	3	25	50	75	2
8	Engineering Chemistry Lab	BS	-	-	3	25	50	75	2
9	Computer Programming Lab	ES	-	-	3	25	50	75	2
	TOTAL		**21**	**3**	**9**	**315**	**510**	**825**	**24**

I B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
FUNCTIONAL ENGLISH (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- To enable the engineering students develop their basic communication skills in English for academic and social purposes.
- To equip the students with appropriate oral and written communication skills.
- To inculcate the skills of listening, reading and critical thinking.
- To integrate English Language learning with employability skills and training.
- To enhance the students' proficiency in reading skills enabling them meet the academic demands of their course

COURSE OUTCOMES:

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

CO1: **Read** and comprehend complex texts actively; guess the meanings of words; recognize key passages; raise questions; draw inferences, summarize texts.

CO2: **Write** paragraphs, essays, emails and letters.

CO3: **Learn** grammatical structures and write grammatically correct sentences.

CO4: **Enhance** word power and usage of lexicons.

TEACHING METHODOLOGY:

- The methodology of teaching will be chalk and talk, PPT, audio-visual and activity based

UNIT-I

Hours of Instruction per unit: 8

HUMOUR: AN ASTROLOGER'S DAY

OBJECTIVE: To criticize the superstitious beliefs of the people in the contemporary society. To make the learners understand that an astrologer is not trustworthy as he deceives the people by bewitching them in order to get some money. So we should not believe anyone by means of outward appearance.

OUTCOME: To students will develop rational thinking instead of believing blindly everything without reason.

a. Vocabulary : Prefixes, Suffixes (www.englishhints.com, www.enchantedlearning.com, www.learnenglish.de/grammar/prefixtext.html)
b. Grammar : Nouns, Pronouns, Articles
c. Writing : Sentences structures

UNIT-II

Hours of Instruction per unit: 8

INSPIRATION: BUILDING A NEW STATE:

OBJECTIVE: To make the students know the value of natural resources that are abundantly available in our country.

OUTCOME: Learner will understand the importance of the natural resources that are valuable in nature in order to develop our nation.

a. Vocabulary : Homophones, Homographs, Homonyms Synonyms & Antonyms and Commonly confused words (http://www.magickeys.com/books/riddles/words.html)
b. Grammar : Finite verbs, Non-finite verbs & question tags
c. Listening : Main points & sub-points
d. Writing : Paragraphs, Note making, Expansion of Proverbs

UNIT-III

Hours of Instruction per unit: 8

SUSTAINABLE DEVELOPMENT: Water: The Elixir of Life

OBJECTIVE: To inform the learner how precious the water is, as well as the advantages and the characteristics of water.

OUTCOME: The learner will understand that water is the elixir of life and it should not be wasted but should be utilized in a proper way.

a. Vocabulary: One Word Substitutes, (http://www.pinnacle.edu.in/campusfiles/1826_campusFile_1.pdf)
b. Grammar: Tenses
c. Listening: Listening for the theme and gist
d. Writing: Official letters, Curricula vitae, Covering Letters

UNIT-IV

Hours of Instruction per unit: 8

RELATIONSHIPS: THE WOOD ROSE

OBJECTIVE: To enlighten the learner the value of human relationships as we are social animals and the need to maintain good relationship with elders and senior citizens.

OUTCOME: The learner will come to know that the old people are not to be ignored but it is the duty of the children to consider the wishes, feelings, emotions, ideas and thoughts of the older generation.

a. Vocabulary: Phrasal verbs & idioms
b. Grammar: Subject verb agreement, Active and Passive voice, Prepositions
c. Listening: Listening for specific detail and information.
d. Writing: Official reports (Fundamentals of technical communication Pg No. 119- 153)

UNIT-V

Hours of Instruction per unit: 8

SCIENCE AND HUMANISIM: PROGRESS

OBJECTIVE: to enable the learner grasp the negative aspect of scientific inventions which are responsible for the anti-social activities of the present day.

OUTCOME: understand that Science and Technology is a double edged knife and must be used with discrimination

a. Vocabulary : collocations, Technical vocabulary, common errors in vocabulary
b. Grammar : conditional sentences, conjunctions, common errors in grammar
c. Listening : Listening for opinions and attitude.
d. Writing : Events and essays

UNIT-VI

Hours of Instruction per unit: 8
READING:

OBJECTIVE: To understand types and sub-skills of reading and apply techniques to improve reading speed.

OUTCOME: demonstrate reading speed and comprehend the gist of passage. Intensive reading, Extensive reading, predicting the content, skimming, scanning, Inferring meanings: lexical and contextual.

TEXTBOOK:

1. Using English – Orient Black Swan Pvt. Ltd. Publishers

REFERENCE BOOKS:

1. Meenakshi raman, Sangeeta, Sharma Fundamentals of technical communication, Pg: 119-153 Oxford University Press, 2015
2. Rutherford, Andrea. J, Basic Communication Skills for Technology. Pearson, New Delhi. 2001
3. Raymond Murphy, Murphy's English Grammar, Cambridge University Press 2004
4. Meenakshi Raman, Sangeeta Sharma, Technical Communication: English Skills for Engineers, Oxford University Press, 2009
5. Michael Swan, Practical English Usage, Oxford University Press, 1996 Online Sources:
6. www.englishhints.com, www.enchantedlearning.com,
7. www.learnenglish.de/grammar/prefixtext.html
8. http://www.magickeys.com/books/riddles/words.html

I B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ENGINEERING MATHEMATICS (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course
- The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.

COURSE OUTCOMES:

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

CO1:Solve ordinary differential equations of first order.

CO2:Solve the second and higher order, Identify the maxima and minima of single variable functions

CO3:Evaluate the maxima and minima of function of two variables.

CO4:Analyze the basic concept of partial differentiation and interpret the one dimension wave equation and one dimension of heat equation.

UNIT - I:

ORDINARY DIFFERENTIAL EQUATIONS: Linear equations of first order, Bernoulli differential equation, exact equations, equations reducible to exact equations. Newton's Law of cooling, natural growth and decay, orthogonal trajectories.

UNIT - II:

LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER: Definitions, Operator D, Rules for finding the complementary functions, Inverse operator, Rules for finding the particular integrals, Method of variation of parameters, Equations reducible to linear equations with constant coefficients. R-L-C circuits, Simple Harmonic motion.

UNIT – III:

MEAN VALUE THEOREMS: Review on limits and continuity, Mean Value theorems (without proofs) Rolle's theorem, Lagrange's theorem, Cauchy's theorem, increasing and decreasing functions, Maxima and minima of function of single variable.

UNIT- IV:

PARTIAL DIFFERENTION: Function of two or more variables, Partial derivatives, Total derivatives, change of variables, Jacobian - functional dependence, Tailor's for Two variables. Maxima and Minima of functions of two variables, Lagrange method of undetermined multipliers.

UNIT- V:

FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange's) equations.

UNIT- VI:

HIGHER ORDER PARTIAL DIFFERENTIAL EQUATIONS: Solutions of Linear Partial differential equations with constant coefficients, Method of separations of Variables, One dimensional wave equation, One Heat equations.

TEXT BOOK:

1. Dr. B.S. Grewal "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, 2012.

REFERENCES:

1. N.P. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, "Engineering Mathematics",
2. University Science Press, (An Imprint of Lakshmi Publications Pvt., Ltd) New Delhi, 2012 2. Keryszig E, "Advanced Engineering Mathematics", 8th Edition, John Wiley, Singapore, 2001.
3. Ravish R Singh, Mukul Bhatt, "Engineering Mathematics" Fourth reprint, McGraw Hill Education Pvt., Lim.,
4. Greenberg M D, "Advanced Engineering Mathematics", 2nd Edition, Pearson Education, Singapore, Indian Print, 2003.
5. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage Learning, 2011.
6. Srimanta Pal and Suboth C. bhunia, "Engineering Mathematics", oxford University Press, 2015.

I B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
MATHEMATICAL METHODS (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering student.
- The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.

COURSE OUTCOMES:

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

CO1: **Solve** simultaneous linear equations using matrix methods.

CO2: **Calculate** Eigen values and Eigen vectors of matrices that are essential for vibration / design analysis.

CO3: **Analyze** the concept of Double and Triple integrals and their applications to calculations of areas, volumes.

CO4: **Solve** simultaneous linear equations using the numerical methods.

UNIT - I:

LINEAR SYSTEMS OF EQUATIONS: Rank of a matrix - Echelon form, Normal form, Solution of linear systems, Direct Methods, Gauss elimination, Gauss Jordon and Gauss Seidal Methods. Solutions of linear simultaneous equations: LU decomposition.

Application: Finding the current in an electrical circuit.

UNIT – II:

EIGENVALUES AND EIGENVECTORS: Eigenvalues, Eigenvectors, Properties, Cayley - Hamilton Theorem, Quadratic forms, Reduction of quadratic form to canonical form, Rank, Positive negative definite, semi definite, index, signature.

Application: Finding powers and inverse of a square matrix using Cayley – Hamilton's Theorem.

UNIT - III:

APPLICATION OF INTEGRATION AND MULTIPLE INTEGRALS: Applications of Integration to Lengths, Volumes and Surface areas of revolution in Cartesian and Polar Coordinates. Multiple Integrals- double and triple integrals, Change of Variables, Change of order of Integration.

UNIT – IV:

SOLUTION OF TRANSCENDENTAL EQUATIONS: Introduction - Bisection Method – Method of False Position – Iteration Method – Newton Raphson Method (One variable and Simultaneous Equations), Secant method.

UNIT – V:

INTERPOLATION: Introduction – Errors in Polynomial Interpolation – Finite differences – Forward Differences – central differences – Symbolic relations and separation of symbols. Differences of Polynomial – Newton's formulae for Interpolation – Interpolation with unevenly spaced points – Lagrange's Interpolation formula – Newton's divided difference formula.

UNIT-VI:

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Solution by Taylor's series, Euler's Method, modified Euler's Method, Runge – kutta Method (fourth order only), R-K method for simultaneous differential equations, Trapezoidal rule, Simpon's $(1/3)^{rd}$ rule, Simpons's $(3/8)^{th}$ rule.

TEXT BOOK:

1. B.S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publisher.

REFERENCES:

1. N.P. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, "Engineering Mathematics", University Science Press, (An Imprint of Lakshmi Publications Pvt., Ltd) New Delhi, 2012.
2. V. Ravindranath and P. Vijayalaxmi, Mathematical Methods, Himalaya Publishing House.
3. Dean G Duffy, advanced Engineering Mathematics with MATLAB, CRC Press.
4. Erwyn Kreyszig, Advanced Engineering Mathematics, 9th Edition, Wiley-India.
5. Srimanta Pal and Suboth C. bhunia, *"Engineering Mathematics"*, oxford University Press, 2015.
6. Steven C.Chapra, Raymond P.Canale "Numerical Methods for Engineers" Tata Mc-Graw Hill.

I B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- For prospective engineers knowledge about water used in industries and for drinking purpose is useful; hence chemistry of hard water, boiler troubles and modern methods of softening hard water are introduced.
- Polymer chemistry may be one of the most relevant of the sub-disciplines of chemistry for the modern citizen. Very few consumer goods are made without a significant contribution from the spectacular applications of polymers. Modern materials depend on large variety of properties available from polymers.
- With the increase in demand, a wild variety of materials coming up. Some of them have excellent engineering properties and a few of these materials are introduced.
- The basics for the construction of galvanic cells as well as some of the sensors used in instruments are introduced. Also if corrosion is to be controlled, one has to understand the mechanism of corrosion which itself is explained by electrochemical theory.
- Fuels as a source of energy are a basic need in industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence they are introduced.
- Photochemistry is to understand the basic principles and types of photochemical reactions. To ensure that students have a good knowledge about photo energy.

COURSE OUTCOMES:

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

CO1: Analyze the water technology deals with the processes and mechanisms that are required to manage the human water cycle.

CO2: Importance of different types of polymers.

CO3: Inspect the materials like naomaterials, fullerenes and liquid crystals, solar cells and cement.

CO4: Distinguish electrical energy sources and importance of corrosion science.

CO5: Analyze the various characterization techniques of fuels and their economics.

CO6: Analyze the basics of photochemistry, Law of absorption of light and applications of Lambert Beer's law.

UNIT - I:

WATER AND ITS INDUSTRIAL APPLICATIONS: Sources of water–Impurities of water–Hardness, types of hardness and its units–Estimation of hardness by EDTA method–Boiler troubles (Sludge and Scale, Priming and Foaming, Caustic embrittlement, Boiler corrosion)–Softening of water–Internal treatment methods– External treatment methods–(Lime–Soda, Zeolite and Ion exchange process)–Desalination of brackish water (Reverse osmosis and Electro dialysis)– Municipal water treatment methods–Problems on hardness and lime-soda process.

UNIT - II:

POLYMER SCIENCE AND TECHNOLOGY: Introduction-Classification of polymers–Polymerization, types and mechanism of polymerization–Stereo regular polymers–Plastics–Thermoplastics and thermosetting plastics– Compounding of plastics–Preparation, properties and applications of Polyethylene, PVC, Bakelite and Polycarbonates–Rubbers and elastomers–Natural rubber, vulcanization– Synthetic rubbers (Buna–N, Buna–S, Thiokol rubber)–Applications–Fiber reinforced plastics, Conducting polymers and Biodegradable polymers.

UNIT - II:

POLYMER SCIENCE AND TECHNOLOGY: Introduction-Classification of polymers– Polymerization, types and mechanism of polymerization–Stereo regular polymers–Plastics– Thermoplastics and thermosetting plastics– Compounding of plastics–Preparation, properties and applications of Polyethylene, PVC, Bakelite and Polycarbonates–Rubbers and elastomers– Natural rubber, vulcanization– Synthetic rubbers (Buna–N, Buna–S, Thiokol rubber)– Applications–Fiber reinforced plastics, Conducting polymers and Biodegradable polymers.

UNIT - III:

CHEMISTRY OF ADVANCED MATERIALS: Nanomaterial's: Types–Preparation of carbon nanotubes and fullerenes–Properties and engineering applications. Liquid crystals: Types and engineering applications. Green Chemistry: Principles–Methods for green synthesis and applications. Cement: Preparation of Portland cement–Setting and hardening of cement. Solar Cells: Solar heaters–Photovoltaic cells–Solar reflectors

UNIT - IV:

ELECTROCHEMICAL CELLS AND CORROSION: Galvanic cells–Single electrode potential–Reference electrodes–Electrochemical series– Batteries (primary, secondary and fuel cells) Corrosion: Causes and effects of corrosion–Theories of corrosion (dry, chemical and electrochemical corrosion)–Factors effecting corrosion–Corrosion control methods–Cathode protection–Sacrificial anodic, Impressed current methods–Surface coatings–Methods of application on metals (Hot dipping, Galvanizing, Tinning, Cladding, Electroplating, Electro less plating)–Organic surface coatings–Paints–Constituents and their functions.

UNIT - V:

FUELS AND COMBUSTION: Fuels–Introduction–Classification–Calorific value–HCV and LCV–Bomb calorimeter– Problems on calorific value (Theoretical and Experimental)–Coal– Proximate and ultimate analysis–Problems on analysis of coal–Petroleum–Refining–Cracking– knocking–Petrol– Synthetic petrol–Gaseous fuels–Natural gas–LPG, CNG–Junker's gas calorimeter– Combustion–Problems on air requirements–Rocket fuels.

UNIT - VI:

PHOTOCHEMISTRY: Photo-excitation of organic molecules–Jablonski Diagram–Laws of Photochemistry and quantum yield–Calorimetric analysis–Photochemical equilibrium– Photosensitization–Some examples of photochemical reactions–Chemistry of vision and other applications of photochemistry.

TEXT BOOKS:

1. Engineering Chemistry, P.C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.
2. A Textbook of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Sons, Delhi.
3. A Textbook of Engineering Chemistry, S.S. Dara, S. Chand & Co. New Delhi.
4. A Text Book of Engineering Chemistry, N.Y.S. Murthy, V. Anuradha, K. Rama Rao, Maruthi Publications.
5. Engineering Chemistry, B. Sivasankar, (2010), McGraw-Hill companies.

REFERENCES:

1. Engineering Chemistry, K. Sesha Maheswaramma and Mridula Chugh (2013), Pearson Publications.
2. A Textbook of Engineering Chemistry, Dr. Y. Bharati Kumari and Dr. Jyotsna Cherukuri, VGS Publications.
3. Text Book of Engineering Chemistry, R. Gopalan, D. Venkatappayya, Sulochana Nagarajan (2011), Vikas Publications.
4. Text Book of Engineering Chemistry, C. Parameswara Murthy, C.V. Agarwal, Adhra Naidu (2006) B.S. Publications.

I B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
PROGRAMMING WITH C (COMMON TO ECE, EEE, CIVIL AND MECHANICAL)							

COURSE OBJECTIVE:

- To gain experience about structured programming
- To help students to understand the implementation of C language
- To understand various features in C

COURSE OUTCOMES:

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

CO1:Develop algorithms and flow charts for simple problems and analyze the basics of C.
CO2:Analyze the concept of arrays and structures for developing code in C.
CO3:Make use of functions in developing modular programs.
CO4:Analyze the use of pointers and dynamic memory allocation technique.
CO5:Make use of structures to write well-structured programs.
CO6:Make use of file Operations in C programming for a given application

UNIT - I:

INTRODUCTION: Computer systems, Hardware and Software Concepts,
PROBLEM SOLVING: Algorithm / Pseudo code, flowchart, program development steps, computer languages: machine, symbolic and high-level languages, Creating and Running Programs: Writing, Editing (vi/emacs editor), Compiling (gcc), Linking and Executing in under Linux.
BASICS OF C: Structure of a C program, identifiers, basic data types and sizes. Constants, Variables, Arthmetic , relational and logical operators, increment and decrement operators, conditional operator, assignment operator, expressions, type conversions, Conditional Expressions, precedence and order of evaluation, Sample Programs.

UNIT - II:

SELECTION – MAKING DECISION:
TWO WAY SELECTION: if-else, null else, nested if, examples, Multi-way selection: switch, else-if, examples.
ITERATIVE: loops- while, do-while and for statements, break, continue, initialization and updating, event and counter controlled loops, looping applications: Summation, powers, smallest and largest.
ARRAYS: Arrays- concepts, declaration, definition, accessing elements, storing elements, Strings and String Manipulations, 1-D arrays, 2-D arrays and character arrays, string manipulations, Multidimensional arrays, array applications: Matrix operations, checking the symmetricity of a Matrix.
STRINGS: concepts, c strings.

UNIT - III:

FUNCTIONS MODULAR PROGRAMMING: Functions, basics, parameter passing, storage classes extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, Recursive solutions for fibonacci series, towers of Hanoi, header files, C Preprocessor, example c programs, Passing 1-D arrays, 2-D arrays to functions.

UNIT - IV:

POINTERS: pointers- concepts, initialization of pointer variables, pointers and function arguments, passing by address- dangling memory, address arithmetic, character pointers and functions, pointers to pointers, pointers and multi-dimensional arrays, dynamic memory management functions, command line arguments

UNIT - V:

ENUMERATED, STRUCTURE AND UNION TYPES: Derived types -structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, bit-fields, program applications.

UNIT - VI:

FILE HANDLING: Input and output- concept of a file, text files and binary files, Formatted I/O, File I/O operations, example programs.

TEXT BOOKS:

1. Programming in C, Reema Thareja, OXFORD.
2. The C programming Language by Dennis Richie and Brian Kernighan 2nd ed..

REFERENCE BOOKS:

1. Programming in ANSI C, Dr.E.Balaguruswamy, Tata McGraw-Hill Education.
2. Problem Solving and Program Design in C, Hanly, Koffman, 7th ed, PEARSON.
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE.
4. Programming in C, Second Edition by Ashok N.Kamthane, Pearson.

I B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
PROFESSIONAL ETHICS, VALUES AND PATENTS (COMMON TO ALL BRANCHES)							

OBJECTIVE:

- To equip the student with the basic knowledge relating to the ethical behavior in engineering discipline.
- To make the students understand the rules and regulation relating to intellectual property rights (Patents, copyrights, trademarks etc.,)

COURSE OUTCOMES:

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

CO1: **Analyze** the fundamentals of Human values.
CO2: **Analyze** the ethical issues and role of engineers in industry.
CO3: **Discuss** the Professional Rights, Responsibilities and Occupational Crimes to prevent Industrial Espionage.
CO4: **Distinguish** the legal tasks and ethical obligations in intellectual property law.
CO5: **Develop** skills to make copy rights, patent requirements and patent registration process.
CO6: **Develop** skills to maintain trade secrets, physical security, employee confidentiality and cyber laws.

UNIT - I:

HUMAN VALUES: Ethics, Morals, Values, Integrity, Work Ethics- Service Learning – Civic Virtue- Respect for Others- Living Peacefully- Caring- Sharing- Honesty- Courage- Value Time- Cooperation- Commitment – Empathy- Self-Confidence- Spirituality- Character.

Unit – II:

ENGINEERING ETHICS: Professional Roles to Be Played By Engineer- Engineers Role As Managers, Consultants And Leaders- Ethical Theories And Its Uses.

UNIT - III:

ENGINEERS RESPONSIBILITIES AND RIGHTS: Professional Rights And Responsibilities, Whistle Blowing, Cross Cultural Issues And Occupational Crimes- Industrial Espionage.

UNIT - IV:

INTRODUCTION TO INTELLECTUAL PROPERTY LAW: The Evolutionary Past - The IPR Tool Kit- Legal Tasks in Intellectual Property Law – Ethical obligations in Intellectual Property Law - Introduction to Cyber Law – Innovations and Inventions Trade related Intellectual Property Right.

UNIT - V:

Intellectual property Rights : Basics, Types of Intellectual Property- Copy Rights – Principles- Subject Matter of Copy Rights- Copy Right Formalities and Registration- Patent Law – Rights and Limitations – Patent Requirements – Patent Registration Process.

UNIT – VI:

TRADEMARK: TRADEMARK REGISTRATION PROCESS: Post Registration Process – Transfer of Rights- Trade Secrets – Maintaining Trade Secrets- Physical Security- Employee Confidentiality Agreement- Cyber Law and Cybercrimes.

TEXT BOOKS:

1. Professional Ethics and Morals by Prof. A.R.Arasri, Dharanikota Suyodhana- Maruthi Publications.

REFERENCES:

1. Deborah e. Bouchoux: “Intellectual property”. Cengage learning, New Delhi.
2. Kompal Bansal & Parishit Bansal” Fundamentals of IPR for Engineers BS a Publications.
3. Cyber Law. Texts & Cases, South- western’s special topics collections.
4. M. Ashok kumar and mohd. Iqbal Ali: “Intellectual property right” serials pub.
5. “Engineering Ethics and Human Values” by M. Govindarajan, S. Natarajan and V.S. Senthil kumar- PHI Learning PVT. Ltd-2009.

I B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
BASIC COMMUNICATION SKILLS LAB (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- To build confidence in the students to communicate effectively in English.
- To strengthen the oral communication to enable them to interact with the people in various social situations.
- To enable the learners develop better pronunciation through emphasis on word accent, intonation and Rhythm

COURSE OUTCOMES:

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

CO1: **Improve** their basic communication skills to interact with peers and others in various social situations.

CO2: **Speak** English effortlessly with good pronunciation through stress on word accent, intonation and rhythm.

CO3: **Take** part in various conversations/discourses using the formal and informal expressions**.**

UNIT - 1:

a. Greeting, Introducing and Taking leave
b. Pure Vowels

UNIT - 2:

a. Giving information and Asking for information
b. Diphthongs

UNIT - 3:

a. Inviting, Accepting and Declining Invitations
b. Consonants

UNIT - 4:

a. Commands, Instructions and Requests
b. Accent and Rhythm

UNIT - 5:

a. Suggestions and Opinions
b. Intonation c.

TEXT BOOK:

1. Strengthen Your Communication Skills – Maruthi Publications, 2013

REFERENCE BOOKS:

1. Personality Development and Soft Skills (Oxford University Press, New Delhi)
2. J.D.O Conner, Better English Pronunciation, Cambridge University Press 1980
3. T.Balasubramanian, A Text Book of English Phonetics for Indian Students, Macmillan, 1981
4. Sanjay Kumar, Pusph Latha, Communication skills, Oxford University Press 2005

I B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
ENGINEERING CHEMISTRY LAB (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- To provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.

COURSE OUTCOMES:

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

CO1: **Examine** the different types of titrations for estimation of concerned in materials using comparatively more quantities of materials involved for good result.

CO2: **Examine** the different types of instruments for analysis of materials using small quantities of materials involved for quick and accurate results.

CO3: **Develop** and perform analytical chemistry techniques to address the water related Problems.

LIST OF EXPERIMENTS:

Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard Solutions, Volumetric titrations, Quantitative analysis, Qualitative analysis etc.

VOLUMETRIC ANALYSIS:

1. Estimation of NaOH using standard HCl solution
2. Estimation of Mohr's salt using potassium dichromate ($K_2Cr_2O_7$) solution
3. Estimation of $CuSO_4$ using sodium thiosulphate ($Na_2S_2O_3$) solution.

WATER ANALYSIS:

1. Determination of hardness of water sample by EDTA method
2. Determination of alkalinity of water sample
3. Determination of free chlorine in bleaching powder
4. Determination of turbidity of water sample

CONDUCTOMETRIC TITRATIONS:

1. Conductometric titration between strong acid and strong base (HCl + NaOH)
2. Conductometric titration between mixture of acids and strong base (HCl and CH_3COOH + NaOH)

FOOD ANALYSIS:

1. Estimation of Vitamin-C

PREPARATION OF POLYMERIC RESINS:

1. Preparation of phenol formaldehyde resin
2. Preparation of urea formaldehyde resin

TEXT BOOKS:

1. Practical Engineering Chemistry by K. Mukkanti, etal, B.S. Publications, Hyderabad.
2. A text book on experiments and calculation Engg. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications
4. Chemistry Practical Manual, Lorven Publications
5. Inorganic quantitative analysis, Vogel.

I B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
COMPUTER PROGRAMMING LAB (COMMON TO ECE, EEE, CIVIL AND MECHANICAL)							

COURSE OBJECTIVE:

- The purpose of this course is to introduce to students to the field of language. The students will be able to enhance their analyzing and problem solving skills and use the same for writing programs in C.

COURSE OUTCOMES:

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

CO1: **Analyze** logical structure of computer programming and different constructs to develop programs in C Language.

CO2: **Categorize** various data types and operator precedence.

CO3: **Analyze** the use of conditional and looping statements to solve problems associated with conditions and repetitions.

SYLLABUS:

EXERCISE 1:

a) Write an Algorithm, Flowchart and Program to calculate the area of triangle using the formula Area = (s (s-a) (s-b) (s-c)) 1/2 where s= (a+b+c)/2.

b) Write an Algorithm, Flowchart and Program to find the largest of three numbers using ternary operator.

c) Write an Algorithm, Flowchart and Program to swap two numbers without using a temporary variable.

EXERCISE 2:

a) Write a C program to find the roots of a quadratic equation.

b) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement).

EXERCISE 3:

a) Write a C program to find the sum of individual digits of a positive integer and find the reverse of the given number.

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

EXERCISE 4:

a) Write a C Program to print the multiplication table of a given number n up to a given value, where n is entered by the user.

b) Write a C Program to enter a decimal number, and calculate and display the binary equivalent of that number.

c) Write a C Program to check whether the given number is Armstrong number or not.

EXERCISE 5:

a) Write a C program to interchange the largest and smallest numbers in the array.

b) Write a C program to input two m x n matrices, check the compatibility and perform addition and multiplication of them.

EXERCISE 6:

a) Write a C Program to find both the largest and smallest number of an array of integers

b) Write a C Program to find transpose of a matrix.

EXERCISE 7:
Write C programs that use both recursive and non-recursive functions for the following
a) To find the factorial of a given integer.
b) To find the GCD (greatest common divisor) of two given integers.

EXERCISE 8:
Write a C Program for the following.
a) To find Fibonacci sequence
b) Write C programs illustrating call by value and call by reference concepts.

EXERCISE 9:
Write C Programs for the following string operations without using the built in functions - to concatenate two strings
a) To append a string to another string b) To compare two strings

EXERCISE 10:
Write C Programs for the following string operations without using the built in functions
a) To find the length of a string
b) To find whether a given string is palindrome or not

EXERCISE 11:
Write a C program that uses functions to perform the following operations:
a) To insert a sub-string in to given main string from a given position.
b) To delete n Characters from a given position in a given string.
c) To replace a character of string either from beginning or ending or at a specified location.

EXERCISE 12:
a) Write a C program to implement a linear search.
b) Write a C program to implement binary search
c) Write a C program to implement sorting of an array of elements.

EXERCISE 13:
a) Write C Program to reverse a string using pointers
b) Write a C Program to compare two arrays using pointers
c) Write a C program to swap two numbers using pointers

EXERCISE 14:
Examples which explores the use of structures, union and other user defined variables

EXERCISE 15:
a) Write a C program which copies one file to another.
b) Write a C program to count the number of characters and number of lines in a file.
c) Write a C Program to merge two files into a third file. The names of the files must be entered using command line arguments.

TEXT BOOKS:
1. Programming in C, Reema Thareja, OXFORD .
2. The C programming Language by Dennis Richie and Brian Kernighan 2nd ed..

REFERENCE BOOKS:
1. Programming in ANSI C, Dr.E.Balaguruswamy, Tata McGraw-Hill Education.
2. Problem Solving and Program Design in C, Hanly, Koffman, 7th ed, PEARSON.
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE.
4. Programming in C, Second Edition by Ashok N.Kamthane, Pearson.

I B.TECH II SEMISTER

I B.Tech - II SEMESTER COURSE STRUCTURE

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Interactive English	HS	4	-	-	40	60	100	3
2	Engineering Physics	BS	3	1	-	40	60	100	3
3	Integral Transforms & Vector Calculus	BS	3	1	-	40	60	100	3
4	Engineering Mechanics	ES	3	1	-	40	60	100	3
5	Engineering Drawing	ES	1	-	4	40	60	100	3
6	Environmental Studies	ES	4	-	-	40	60	100	3
7	Enhancing Communication Skills Lab	BS	-	-	3	25	50	75	2
8	Engineering Physics Lab	BS	-	-	3	25	50	75	2
9	Engineering Work Shop	ES	-	-	3	25	50	75	2
	TOTAL		**18**	**3**	**13**	**315**	**510**	**825**	**24**

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
INTERACTIVE ENGLISH (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- To enable the engineering students develop their basic communication skills in English for academic and social purposes.
- To equip the students with appropriate oral and written communication skills.
- To enhance the skills of listening, reading and critical thinking.
- To integrate English Language learning with training for employability skills.

COURSE OUTCOMES:

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

CO1: **Read** and comprehend complex texts actively; guess the meanings of words; recognize key passages; raise questions; draw inferences, summarize texts.
CO2: **Write** paragraphs, essays, emails and letters.
CO3: **Learn** grammatical structures and write grammatically correct sentences.
CO4: **Enhance** word power and usage of lexicons**.**

TEACHING METHODOLOGY: The methodology of teaching will be chalk and talk, PPT, audio-visual, and activity based.

PART-I COMMUNICATION SKILLS

Hours of Instruction per week: 8

OBJECTIVES:

1. Understand the significance of using formal language in communication and Identify different language patterns in communication.
2. Understand the importance of clarity and conciseness of writing.
3. To enhance word power and usage of lexicons among the learners.

OUTCOMES:

1. Apply Formal and Informal Language in office correspondence and real life situations.
2. Apply the Clarity, Conciseness and Formal language in E-mail writing, letter writing, report writing, paragraph writing and essay writing.
3. Use words in different contexts while speaking and decipher meaning of the words contextually while reading.

EFFECTIVE COMMUNICATION:

1. Role and significance of communication
2. Features of Human Communication
3. Process of Communication
4. Types of Communication, barriers to communication

ORAL COMMUNICATION:

1. Importance of Listening for effective communication
2. Interpersonal communication
3. Models of Interpersonal relationship development
4. Styles of communication
5. Persuasion techniques
6. Telephone and Cell phone etiquette

WRITTEN COMMUNICATION:

a. Paragraph writing b. Summaries c. Expansion of Proverbs d. Essay writing
e. Report writing f. The scientific paper g. Letter writing h. Letters of Complaint
i. Request to complaint j. letters of inquiry and responses k. Resume writing l. Visumes m. statement of purpose n. E-mail (Fundamentals of technical communication Pg No. 119 - 153)

REMEDIAL ENGLISH:

a. Importance of vocabulary and grammar
b. Homonyms, Homophone and Homographs
c. Synonyms and antonyms
d. One word substitutes
e. Idioms
f. Words often confused
g. Subject-Verb agreement
h. Active and passive voice
i. Direct and indirect speech
j. Articles
k. Adjectives
l. Prepositions
m. Tense and aspect
n. Suffixes
o. Question tags
p. Prefixes
q. Punctuation
r. Common Errors
s. Correction of common errors

PART - II
READING FOR ENRICHMENT

OBJECTIVES:

To inspire the learners by giving the success stories of the various fields and teach them that achievement comes only after burning the midnight oil.

OUTCOMES:

The students will emulate the achievers and develop perseverance, determination, dedication and industry

1. APJ Abdul Kalam
2. An Interview with Microsoft CEO Satya Nadella
3. Azim Premji
4. Sachin Tendulkar
5. Sam Pitroda: The Knowledge Revolution
6. Indra Nooyi: http://www.thefamouspeople.com/profiles/indra-nooyi-6440.php

TEXTBOOK:

1. E Suresh Kumar, Engineering English –Orient Black Swan Pvt.Ltd. Publishers.

REFERENCE BOOKS:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011
2. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001
3. Raymong Murphy, Murphy's English Grammar, Cabridge University Press 2004
4. Meenakshi Raman, Sangeeta Sharma. Technical Communication: English Skills for Engineers, Oxford University Press, 2009
5. Meenakshi raman, Sangeeta Sharma, Fundamentals of technical communication, Oxford University Press, 2015.

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVE:

- Physics is the foundation subject to all engineering and through the study in engineering physics the main aim is blending a strong physics component with relevant engineering backgrounds that are usually necessary to work in areas such as semiconductor, optical technologies, mechanical, electrical, and civil engineering.
- The students will get their traditional undergraduate engineering education that has a broad foundation in mathematics, engineering sciences and technology. This program emphasizes problem solving skills and an understanding of engineering design to address the needs and challenges of the technology age and allow students to take a broad range of engineering careers.

COURSE OUTCOMES:

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

CO1:Evaluate the experimental evidence of wave nature of light and interference in thin films, Diffraction grating and Polarization in various fields.
CO2:Analyze and understand various types of lasers & optical fibers.
CO3:Identify the crystal structures and XRD techniques.
CO4:Identify the use of Acoustics and Ultrasonic in engineering field.
CO5:Analyze the free electron theory and quantum mechanics.
CO6: Analyze the concept of effective mass of electron and hole, conductors, semiconductors and insulators.

UNIT - I:

INTERFERENCE: Introduction – Coherent Sources -Interference in thin films by reflection – Newton's rings – Principle – construction- determination of radius of curvature of plano convex lens.

DIFFRACTION : Introduction – Fraunhofer diffraction - Fraunhofer diffraction at single slit- double slit (qualitative) – Diffraction grating – Grating spectrum

POLARIZATION: Introduction – Types of Polarization – Double refraction – Quarter wave plate ad Half Wave plate

UNIT – II:

LASERS: Introduction – Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Ruby laser – Helium Neon laser-Applications

FIBER OPTICS: Introduction- Principle of optical fiber - Acceptance angle – cone - Numerical Aperture-Applications

UNIT - III:

CRYSTALLOGRAPHY: Introduction – Space lattice – Basis – Unit Cell – Lattice parameters – Bravais lattices – Crystal systems – Structures and packing fractions of SC, BCC and FCC.

X- RAY DIFFRACTION TECHNIQUES: Directions and planes in crystals – Miller indices – Separation between successive (h k l) planes – Bragg's law.

UNIT – IV:

ULTRASONIC: Introduction – properties - Production of Ultrasonic waves –Piezo electric effect, Magnetostriction methods -Applications.

ACOUSTICS: Introduction-Sound absorption-absorption coefficient-Reverberation Time-Sabine's formula-Eyring's formula

UNIT – V:

FREE ELECTRON THEORY: Classical free electron theory – Quantum free electron theory – Fermi dirac (analytical) and its dependence on temperature-Fermi energy-Density of states.

QUANTUM MECHANICS: Introduction – Matter waves – Physical significance of wave function - Schrodinger Time Independent wave equations – Particle in a one dimensional potential box.

UNIT – VI:

BAND THEORY OF SOLIDS: Bloch theorem (qualitative) – Kronig-Penny model - boundary conditions-origin of energy band formation in solids- concept of effective mass of electron and hole-classification of materials into conductors, semiconductors and insulators.

SEMICONDUCTOR PHYSICS: Introduction –Intrinsic, Extrinsic semiconductor and carrier concentrations – Fermi level in intrinsic and extrinsic semiconductors- Hall Effect.

TEXT BOOKS

1. Solid state Physics by A.J. Dekker (Mc Millan India Ltd)
2. A text book of Engineering Physics by M.N. Avadhanulu & P.G. Kshirasagar (S. Chand publications)
3. Engineering Physics by Palanisamy (Scitech Publishers)
4. Engineering Physics by M.R. Srinivasan (New Age international publishers)

REFERENCE BOOKS:

1. Introduction to solid state physics by Charles Kittle (Willey India Pvt.Ltd)
2. Applied Physics by T. Bhimasenkaram (BSP BH Publications)
3. Applied Physics by M.Arumugam (Anuradha Agencies)
4. Engineering Physics by D.K.Bhattacharya (Oxford University press)
5. Engineering Physics by Mani Naidu S (Pearson Publications)
6. Engineering Physics by Sanjay D Jain and Girish G Sahasrabudhe (University Press)
7. Engineering Physics by B.K.Pandey & S. Chaturvedi (Cengage Learning)

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
INTEGRAL TRANSFORMS AND VECTOR CALCULUS (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering student.
- The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.

COURSE OUTCOMES:

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

CO1: **Select** the technique of Laplace transforms and Z- transforms by apply it to solve differential equations.

CO2: **Interpret** the physical meaning of different operators as gradient, curl and divergence.

CO3: **Estimate** the work done against a field, circulation and flux using vector calculus.

CO4: **Relate** Fourier series, integral, transforms and they are provided with practice in their application and interpretation in a range of situations.

UNIT – I:

LAPLACE TRANSFORMATIONS: Laplace transform and its properties, Unit step function and unit impulse function, Transform of periodic functions, Transform of derivatives and integrals, Multiplication by t^n, division by t, evolutions of integrals by Laplace Transforms. Inverse Laplace Transformations. Introduction, Finding inverse transforms by the method of partial fractions, other methods of finding inverse Laplace Transforms, Convolution theorem(without proof), Solutions Initial and Boundary Value Problems.

UNIT – II:

Z – TRANSFORMS: Introduction, properties, Damping rule, Shifting rule, Initial and Final value theorems, Inverse z-transform, Convolution theorem, Solutions of difference equations.

UNIT - III:

VECTOR DIFFERENTIATION: Gradient, Divergence, Curl, Laplacian and second order operators, vector identities, Equation of continuity, potential surfaces.

UNIT - IV:

VECTOR INTEGRATION: Line integral, work done, potential function, area surface and volume integrals, vector integral theorems: Green's, Stoke's and Gauss Divergence theorems (without proof) and related Problems.

UNIT – V:

FOURIER SERIES: Introduction, Euler's Formulae, Conditions for a Fourier expansion, Functions having points of Discontinuity, change of interval, even and odd functions, Half – range sine and cosine series.

UNIT – VI:

FOURIER TRANSFORMS: Introduction, Definition, Fourier Integrals, Fourier Sine and Cosine Integral, Fourier Transforms, Fourier sine and cosine transforms, Finite Fourier transforms.

TEXT BOOK:

1. B.S.Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publisher.

REFERENCES:

1. N.P. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, "Engineering Mathematics", University Science Press, (An Imprint of Lakshmi Publications Pvt., Ltd) New Delhi, 2012.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGrawhill.
3. Erwyn Kreyszig, Advanced Engineering Mathematics, 9thEditiwiley-India.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage Learning, 2011.
5. Srimanta Pal and Suboth C. bhunia, *"Engineering Mathematics"*, oxford University Press, 2015.

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ENGINEERING MECHANICS (COMMON TO ME, CE BRANCHES)							

COURSE OBJECTIVES:

The course is mainly intended

- To impart the basic concepts and fundamentals of Engineering Mechanics and the principles of various force systems under static and dynamic conditions
- To develop the problem solving skills of engineering mechanics essential for mechanical engineering

COURSE OUTCOMES:

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

CO1: **Apply** the principles of mechanics to determine the resultant of several concurrent forces acting on a particle.
CO2: **Determine** the Frictional Forces on moving bodies and apply in real life problems
CO3: **Evaluate** the centroid and Centre of gravity bodies and composite sections.
CO4: **Evaluate** the Area Moment of Inertia of Inertia of bodies and composite sections.
CO5: **Determine** the Mass Moment of Inertia of bodies and composite sections.
CO6: **Apply** the work-energy principle to particles and connected systems for engineering Applications.

UNIT – I:

Introduction to Engineering Mechanics-Basic concepts
RESULTANT OF COPLANAR CONCURRENT FORCE SYSTEM: Parallelogram law, Graphical method, Method of resolution.
EQUILIBRIUM OF FORCE SYSTEMS: Free body diagrams, Equations of Equilibrium for coplanar concurrent force system, Lami's theorem.
MOMENTS: Moment of Force and its Applications, Principle of moments – Couples and Resultant of Force Systems.

UNIT - II:

FRICTION: Introduction, Classification of friction, Laws of Friction, Coefficient of Friction, Angle of Friction, Angle of Repose, Frictional Forces on moving bodies, Wedge friction, Ladder friction.

UNIT - III:

CENTROID: Centroids of simple figures (from basic principles)-Centroids of composite figures, Centre of Gravity: Centre of Gravity of simple body (from basic principles), Centre of gravity of composite bodies, pappus theorem.

UNIT - IV:

AREA MOMENTS OF INERTIA: Definition, Radius of gyration, Parallel axis theorem, perpendicular axis theorem, Moments of Inertia of composite figures, polar moment of Inertia.

UNIT – V:

MASS MOMENT OF INERTIA: Moment of Inertia of Rigid body-Moment of Inertia from basic principles-Slender bar, Rectangular Plate, Circular Plate, Moment of Inertia of 3D Bodies Cone, Solid Cylinder, Solid Sphere.

UNIT - VI:

KINETICS: Analysis as a particle, Newton's laws of motion, D'Alembert's principle –simple applications- analysis as a rigid body in translation-fixed axis rotation-Simple applications.

WORK-ENERGY METHOD: Equations for Translation, work-Energy applications to particle motion, connected system-Impulse momentum method-simple applications.

TEXT BOOKS:

1. Engg. Mechanics by S.Timoshenko & D.H.Young., 4th Edn - ,Mc Graw Hill publications.
2. Engg. Mechanics by S.S. Bhavikatti-New age publications

REFERENCES:

1. Engineering Mechanics by Fedinand . L. Singer , Harper – Collins.
2. Engineering Mechanics by A.K.Tayal-Umesh Publications.

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	-	4	40	60	100	3
ENGINEERING DRAWING (COMMON TO ME, CE, BRANCHES) (NOTE: USE I ANGLE PROJECTIONS ONLY)							

COURSE OBJECTIVES:

The course is mainly intended to

- Impart basic knowledge and skills required to prepare engineering drawing which is an universal language of engineers for communication, designing and production
- Get enhanced imagination capacity, visualize and communicate geometrical elements
- Understand the fundamentals of geometry like engineering curves, planes, solids, sections, developments & isometric views and its applications in design and manufacturing of various engineering components.

COURSE OUTCOMES:

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

CO1: **Apply** principles of drawing to represent dimensions of an object and use the different types of scales for drawing of various sizes of engineering curves
CO2: **Develop** the orthographic projections, projections of points, and Projection of straight lines.
CO3: **Construc**t the projection of straight lines inclined to both the planes.
CO4: **Construct** the projection of planes inclined to both the planes.
CO5: **Develop** the projection of regular solids and surfaces.
CO6: **Interpret** the conversion of isometric views to orthographic views vice versa.

UNIT - I:

INTRODUCTION TO ENGINEERING DRAWING: Importance, construction of regular polygons. Conic sections: Construction of Ellipse, parabola & Hyperbola by general Method, ellipse by others methods- Arcs of circles Method, Concentric Circles Method and Oblong Method. Scales: Representation fraction-Construction of plain, diagonal and vernier scale.

UNIT - II:

ORTHOGRAPHIC PROJECTIONS: Principle of orthographic projections, projections, of points. Projection of Straight lines: parallel to both the planes, parallel to one plane and inclined to the other plane.

UNIT - III:

Projection of Straight lines inclined to both the planes, determination of true length, angles of inclination and Traces.

UNIT – IV:

PROJECTIONS OF PLANES: regular planes perpendicular/parallel to one plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT - V:

PROJECTIONS OF SOLIDS: prisms, pyramids, cones and cylinders with the axis inclined to one of the planes

DEVELOPMENT OF SURFACES of right regular solids- Prisms, Cylinder, Pyramids, Cone.

UNIT - VI:

Conversion of isometric views to orthographic views; Conversion orthographic views to isometric views

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers.
3. Engineering Graphics by PI Varghese, McGrawHill Publishers

REFERENCE BOOKS:

1. Engineering Graphics for Degree by K.C. John, PHI Publishers
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ENVIRONMENTAL STUDIES (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- To make the students aware about the environment and it's inter–disciplinary, Basic understanding of the ecosystem and its diversity.
- Human development and societal development is inevitable. This development is entirely depends on science and Technological advancement through using resource assets of nature. In order to reduce the impacts of the technological development, the environmental studies creating awareness among the engineering graduates. So that we can have a healthy environment present and future.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- The course covers the aspects like general awareness, Resources, Utilization and conservation, Healthy sustenance of life, pollution control, social aspects, etc. All these areas will provide and habituate the students towards conservation and sustainable development.
- Overall understanding of the natural resources.

COURSE OUTCOMES:

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

CO1: **Explain** the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web.

CO2: **Analyze** the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources.

CO3: **Explain** the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity.

CO4: **Distinguish** various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management practices.

CO5: **Analyze** the traditional and modern techniques of global environmental problems and global efforts

CO6: **Analyze** Environmental policy, legislation, environmental assessment and the stages involved in EIA Environmental audit.

UNIT – I:

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES:

Definition, Scope and importance–Need for public awareness–Institutions and people in environment.

ECOSYSTEMS: Definitions and concepts–Characteristics of ecosystem–Structural and functional features–Producers, consumers, decomposers and food webs–Types of ecosystems– Forests, grassland, desert, crop land, pond, lake, river and marine ecosystems– Energy flow in the ecosystem–Ecological pyramids–Ecological successions.

UNIT – II:

NATURAL RESOURCES:

FOREST RESOURCES: Use and over–exploitation–Deforestation–Water resources–Use and over utilization of surface and natural resourced ground water–Floods and droughts–Conflicts over water–Dams, benefits and problems on tribal population & Environment

.

MINERAL RESOURCES: Use and exploitation–Environmental effects of extracting and using mineral resources.

FOOD RESOURCES: World food problems–Changes caused by agriculture and overgrazing–Effects of modern agriculture–Fertilizer and pesticide problems–Water logging, salinity– Concept of sustainable agricultural methods.

LAND RESOURCES: Land as a resource–Land degradation, man induced landslides–Soil erosion and desertification.

UNIT – III:

BIODIVERSITY AND ITS CONSERVATION: Levels and Values of biodiversity–India as a mega diversity nation–Hotspots–Threat and conservation of biodiversity–Assessment of biodiversity and its impact on Environment.

UNIT – IV:

ENVIRONMENTAL POLLUTION AND CONTROL: Definition, Cause, effects and control measures of a. Air pollution, Water pollution, Soil pollution, Noise pollution.

UNIT – V:

GLOBAL ENVIRONMENTAL PROBLEMS AND GLOBAL EFFORTS: Climate change–Global warming–Acid rain–Ozone layer depletion–Nuclear accidents and holocaust–Rain water harvesting–Traditional and modern techniques–Environmental legislation–Wasteland reclamation–Consumerism and waste products.

UNIT – VI:

ENVIRONMENTAL MANAGEMENT: Impact Assessment and its significance–various stages of EIA–Preparation of EMP and EIS– Environmental audit–Ecotourism. The student should submit a report individually on any issues related to environmental studies course and make a power point presentation.

TEXT BOOKS:

1. An Introduction to Environmental Studies by B. Sudhakara Reddy, T. Sivaji Rao, U. Tataji & K. Purushottam Reddy, Maruti Publications.
2. Anubha Kaushik & C.P. Kaushik. 2014, Environmental Studies, Fourth edition, New Age International (P) Ltd., New Delhi.

REFERENCES:

1. Text Book of Environmental Studies by Deekshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada.
3. Text Book of Environmental Sciences and Technology by M. Anji Reddy, BS
4. Publications.
5. Bharucha, E. 2005, Text book of Environmental Studies, First edition, Universities Press (India) Pvt., Ltd., Hyderabad.
6. Dr. S. Keerthinarayana & Dr. C. Daniel Yesudian. 2004, Principles of Environmental Science and Engineering, First edition, Anuradha Publications (P) Ltd., Kumbakonam.
7. P. Anandan & R. Kumaravelan. 2010, Environmental Science & Engineering, Sixth reprint, Scitech Publications (India) (P) Ltd., Chennai.
8. Dr. Surinder Deswal & Dr. Anupama Deswal. 2008-09, A Basic Course in Environmental Studies, Second revised edition, Dhanpat Rai & Co (P) Ltd., New Delhi.

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
ENHANCING COMMUNICATION SKILLS LAB (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVES:

- To train the students to use language effectively in professional situations like group discussions, public speaking, presentations and interviews.
- To make the students understand the importance of body language.
- To develop positive attitude and soft skills to improve their employability quotient.
- To expose the students to variety of a self-instructional, learner friendly, electronic media and stimulate intellectual faculties/resources

COURSE OUTCOMES:

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

CO1: **Give** presentations and attend GDs and job interviews confidently.
CO2: **Speak** confidently in challenging situations.
CO3: **Know** the importance of Non-verbal communication and interpret nonverbal symbols.

UNIT - 1: BODY LANGUAGE

UNIT - 2: DIALOGUES

UNIT - 3: PRESENTATION SKILLS

UNIT - 4: GROUP DISCUSSION

UNIT - 5: INTERVIEWS AND TELEPHONIC INTERVIEWS

UNIT - 6: DEBATES

TEXT BOOK:

1. Strengthen your Communication Skills by Maruthi Publications, 2013

REFERENCE BOOKS:

1. Personality Development and Soft Skills (Oxford University Press, New Delhi)
2. M Ashraf Rizvi, Effective Technical Communication skills, McGraw-Hill, 2005
3. Barun K Mitra, Personality Development and Soft Skills, Oxford University Press, 2011
4. Konar N, Communication Skills for Professionals, PHI Learning Private Limited, 2011

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
ENGINEERING PHYSICS LAB (COMMON TO ALL BRANCHES)							

COURSE OBJECTIVE:

- The main aim of the course is to acquaint the students with basic concepts in Engineering Physics using the following illustrative list of experiments.

COURSE OUT COMES:

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

CO1: **Explain** the principle of physics and interpret them in engineering field and compares the results with theoretical calculations.

CO2: **Utilize** modern engineering physics techniques and tools in real time applications in engineering studies.

CO3: **Identify** the characteristics and the behavior of materials in a practical manner and gain knowledge and its usage.

LIST OF EXPERIMENTS:

1. Newton's rings –Radius of Curvature of Plano Convex Lens.
2. Determination of thickness of thin wire- Air wedge method
3. Determination of wavelength of a source-Diffraction Grating-Normal incidence
4. Determination of wavelength of Laser Source-single slit diffraction.
5. Determine the Numerical aperture of an optical fiber.
6. Determination of velocity of ultrasonic waves in liquids-ultrasonic interferometer.
7. Melde's experiment – Transverse and Longitudinal modes.
8. Determination of velocity of sound-Volume resonator
9. Verification of laws of vibrations in stretched strings - Sonometer.
10. Hall effect in semiconductors
11. Energy Band gap of a Semiconductor p - n junction.
12. Characteristics of Thermistor- Temperature coefficient.

REFERENCES:

1. Engineering Physics Lab Manual by Dr.Y. Aparna & Dr.K.Venkateswarao (V.G.S.Book links).
2. Physics Practical Manual, Lorven Publications.

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
ENGINEERING WORKSHOP (COMMON TO ME, CE BRANCHES)							

COURSE OBJECTIVES:

- To impart knowledge to students to develop their technical skill sets for creating entities from raw material.
- To give hands on training and practice to students for use of various tools, devices, machines.
- To develop ability of students to understand, plan and implement various processes and operations to be performed on the raw material to create object of desired shape and size.

COURSE OUTCOMES:

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

CO1: Make Use of the various carpentry and fitting tools, machines, devices used in engineering practice for preparing different joints.

CO2: Develop funnel and square box thorough knowledge of various Tin Smithy tools.

CO3: Make use of the various house wiring connections, Welding and Black Smithy.

.

LIST OF EXPERIMENTS:

TRADES FOR EXERCISE:

ϖ **CARPENTRY**

1. Cross-Lap joint
2. Dove tail joint
3. Mortise & Tenon joint

ϖ **FITTING**

1. V-fit
2. Square fit
3. Dovetail fit

ϖ **TINSMITHY**

1. Funnel
2. Square box without lid
3. Tapper tray

ϖ **HOUSE WIRING**

1. Two lamps series connection & parallel connection
2. Fluorescent Tube Wiring & Stair Case Wiring

TRADES FOR DEMONSTRATION

ϖ **BLACK SMITHY**

1. S-Hook
2. Round rod to square rod

ϖ **WELDING**

1. Lap Joint
2. Butt Joint

TEXT BOOKS:

1. K.C. John, “Mechanical Workshop” 2nd Edn., PHI,2010.
2. Kannaiah P. & Narayana K. C., "Manual on Work Shop Practice", Scitech Publications, Chennai, 1999.

REFERENCE BOOKS:

1. Hajra Choudary, “Elements of Workshop Technology-Vol. 1, Asian Publishers, 6th Edn., 1993.
2. G.S. Sawhney, “Mechanical Experiments and Workshop Practice”, I.K.International Publishing House, New Delhi, 2009.

II B.TECH I SEMISTER

II B.Tech - I SEMESTER COURSE STRUCTURE

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Basic Electrical & Electronics Engineering	ES	3	1	-	40	60	100	3
2	Mechanics of Solids	ES	3	1	-	40	60	100	3
3	Material Science & Metallurgy	ES	4	-	-	40	60	100	3
4	Thermodynamics	PC	3	1	-	40	60	100	3
5	Fluid Mechanics	ES	3	1	-	40	60	100	3
6	Machine Drawing and CAD Lab	PC	1	-	4	40	60	100	3
7	BEE&E Lab	ES	-	-	3	25	50	75	2
8	Mechanics of Solids and Metallurgy Lab	PC	-	-	3	25	50	75	2
9	Verbal Ability (Mandatory Non Credit Course)	MDC	3	-	-	-	-	-	-
	TOTAL		**20**	**4**	**10**	**290**	**460**	**750**	**22**

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
BASIC ELECTRICAL AND ELECTRONICS ENGINEERING							

COURSE OUTCOMES:

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

CO1: **Analyze** the various electrical networks.
CO2: **Discuss** about the operations of DC machines, AC Machines and Transformers.
CO3: **Evaluate** the performance of transformers, DC machines and AC Machines.
CO4: **Analyze** the operation and applications of diodes, transistors and OP-AMPs

UNIT - I:
ELECTRICAL CIRCUITS
Basic definitions - Types of network elements - Ohm's Law - Kirchhoff's Laws - inductive networks - capacitive networks - series, parallel circuits - star-delta and delta-star transformations.

UNIT - II:
DC MACHINES
Principle of operation of DC generator - emf equation - types - DC motor types - torque equation - applications - three point starter - Swinburne's Test - speed control methods – (Simple Problems Only).

UNIT - III:
TRANSFORMERS
Principle of operation of single phase transformers - emf equation - losses - OC and SC test and efficiency – regulation – (Simple Problems Only).

UNIT - IV:
AC MACHINES
Principle of operation of alternators - regulation by synchronous impedance method - principle of operation of 3-Phase induction motor - slip-torque characteristics - efficiency – applications - (Simple Problems Only).

UNIT - V:
DIODES & TRANSISTORS
PN junction diodes - diode applications (Half wave and bridge rectifiers) - PNP and NPN junction transistor - transistor as an amplifier - single stage CE Amplifier - frequency response of CE amplifier - concepts of feedback amplifier.

UNIT - VI:
LINEAR ICS
Characteristics of operation amplifiers - application of OP-AMPs (inverting, non-inverting, integrator and differentiator).

TEXT BOOKS:

1. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor & Francis Group
2. Principles of electrical and electronics by V.K.Mehta, RohitMetha, S.Chand Publications.

REFERENCE BOOKS:

1. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMH Publications.
2. Basic Electrical Engineering by Nagsarkar, Sukhija, OxfordElectronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky,9th edition, PEI/PHI 2006.

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
MECHANICS OF SOLIDS							

COURSE OUTCOMES:

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

CO1: Analyze the concepts of stress and strain and thermal stress in members, stresses on inclined planes with graphical approach.
CO2: Construct the shear force diagrams and bending moment diagrams at different load conditions
CO3: Determine shear stresses induced in the beams with different cross sections
CO4: Evaluate slope and deflection of beams at different support arrangements
CO5: Distinguish thin and thick cylinders subjected to internal, external pressures.
CO6: Examine the torsional deflections of circular shafts and columns

UNIT-I:

SIMPLE STRESSES & STRAINS: Elasticity and plasticity – Types of stresses & strains-tensile compressive, shear –Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars. Relation between elastic constants-E,G&K. Temperature stresses- Principal planes and principal stresses - Mohr's circle. Strain Energy- sudden, gradual and Impact loadings.

UNIT-II:

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams-cantilever beam, simply supported beam, overhanging beam– Concept of shear force and bending moment– S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, Uniform Distributed Load (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: Theories of bending–Assumptions–Derivation of bending equation, Neutral axis–Determination bending stresses–section modulus of rectangular and circular sections (Solid and Hollow), I, T, section.

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

UNIT-IV:

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, Mohr's theorems – Moment area method.

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.

THICK CYLINDERS: lame's equation–cylinders subjected to inside & outside pressures–compound cylinders

UNIT-VI:

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

COLUMNS: Buckling and Stability, Columns with Pinned ends, eccentric loading and initial curvature loading, Limitations of Euler's Formula, Rankin'sFormula.

TEXT BOOKS:

1. Strength of materials by Bhavikatti, Lakshmi publications.
2. Strength of materials by R. K. Bansal, Lakshmi publications

REFERENCES:

1. Mechanics of Materials (In Si Units) by Beer and Johnson, Tata McGraw-Hil
2. Strength of Materials (Mechanics of Materials) by James M.Gere and Barry J.Goodno, PWS- KENT Publishing Company, 1990
3. Strength of Materials (Mechanics of Solids) by R.K. Rajput , S.Chand Publications

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
MATERIAL SCIENCE & METALLURGY							

COURSE OUTCOMES:

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

CO1: Categorize the structure and properties of materials and crystal systems
CO2: Distinguish phase diagrams of different alloys
CO3: Analyze the properties of ferrous materials and their engineering applications
CO4: Explain the concepts of heat treatment processes and their applications
CO5: Examine different nonferrous materials properties and their engineering applications
CO6: Categorize the ceramics, composite materials and the powder metals

UNIT – I:

STRUCTURE OF METALS AND CONSTITUTION OF ALLOYS: Bonds in Solids– Ionic, Covalent and Metallic bonds; Classification of solids – Amorphous and Crystalline solids**.** Crystal structure-BCC, FCC, HCP. **Crystallization of metals**– Nuclei formation and Crystal growth, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys, Grain size and methods of grain size measurements; Necessity of alloying, types of solid solutions-substitutional solid solutions and Hume Rothery rules of solid solubility, interstitial solid solutions, Intermediate alloy phases- Intermetallic, Interstitial and electron compounds.

UNIT – II:

EQUILIBRIUM DIAGRAMS: Introduction to Phase and Phase diagrams with its Importance and types-Unary, Binary and Ternary phase diagrams; Study of important binary phase diagrams of Fe-Fe_3C and Cu-Ni.Micro constituents in steels- Austenite, Ferrite, Cementite, Pearlite, Bainite, Martenite; eutectic, peritectic, eutectoid and peritectoid reactions.Cooling curve of pure iron, Lever Rule, Gibbs Phase Rule.

UNIT – III:

Steels: Introduction, Classification and Influence of constituents on steel; Structure, properties and applications of plain carbon steels; Alloy steels-Purpose and effect of alloying elements; Properties of - manganese steels, Stainless steels, tool and die steels.
Cast Irons: Introduction, comparison with steels and Classification; Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, S.G. cast iron.

UNIT – IV:

HEAT TREATMENT OF ALLOYS: Introduction to furnaces and purpose of heat treatment; Process and applications of Annealing, normalizing, Hardening and tempering; Effect of cooling on austenite transformation, TTT diagrams, Hardenability and factors affect hardening;Surface Hardening of Steels- Carburizing, Nitriding, Cyaniding.

UNIT – V:

NON-FERROUS METALS AND ALLOYS: Introduction, Structure and properties of copper Aluminium, Titanium and their alloys.

UNIT – VI:

CERAMICS: Introduction; Crystalline ceramics, glasses, ceramets, abrasive materials.
COMPOSITE MATERIALS: Composites- Introduction, types-particle reinforced, fiber reinforced and structural composites, applications and reinforcing materials.
POWDER METALLURGY - Introduction, preparation, industrial applications, advantages and limitations.

TEXT BOOKS:

1. Introduction to Physical Metallurgy by Sidney H. Avener, Tata McGraw Hill
2. Material Science and Metallurgy by V.D.Kodgire, Everest Publishing House

REFERENCES:

1. Materials Science and engineering by Callister and Baalasubrahmanyam, Wiley India
2. Material science and Engineering by V. Rahghavan, P.H.I Publications
3. Material Science and Metallurgy by A V K Suryanarayana, B S Publications
4. Material Science and Metallurgy by U. C. Jindal by Pearson Publications

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
THERMODYNAMICS							

COURSE OUTCOMES:

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

- **CO1: Analyze** the basic concepts of thermodynamics and forms of energy
- **CO2: Apply** mass and energy balance equations for open and close thermodynamic systems.
- **CO3: Analyze** the Second law of thermodynamics and the concepts of entropy
- **CO4: Evaluate** the properties of pure substances using Rankine cycle
- **CO5: Examine** the nature of gases and calculate the enthalpy of gases
- **CO6: Estimate** the efficiency and performance parameters of air standard cycles..

UNIT - I:

FUNDAMENTAL CONCEPTS AND DEFINITIONS : Thermodynamic system and control volume, Macroscopic and microscopic study, properties and state of a substance, Thermodynamic equilibrium and Quasi-static Process, thermodynamic path, cycle, Zeroth law, concept of temperature, Perfect gases, Equation of a state for perfect gas.

Work and Heat: Definition of work, units, work done at the moving boundary of a system, work done in various non-flow processes, definition of heat, units, comparison of heat and work.

UNIT - II:

FIRST LAW FOR NON FLOW SYSTEMS: First law of thermodynamics for a system undergoing a cycle and for a change in state of system, internal energy and enthalpy, constant volume and constant pressure specific heats and their relation to internal energy and enthalpy of ideal gases.

First law for flow systems: Control mass and control volume, first law of thermodynamics for a control volume, steady flow energy equation and applications

UNIT - III:

SECOND LAW OF THERMODYNAMICS: Limitations of First law of thermodynamics. Heat engines, Heat Pumps and Refrigerators. Statements of Second law of Thermodynamics, Carnot cycle and the two propositions regarding the efficiency of Carnot cycle, Thermodynamic temperature scale, processes-reversible and irreversible, factors that render a process irreversible.

ENTROPY: Inequality of Classius, Entropy change in reversible process, T-dS relations, Maxwell relations, Entropy change of a system during an irreversible process, Principle of increase of entropy, Entropy change of an ideal gas, introduction to Exergy, and irreversibility.

UNIT - IV:

PURE SUBSTANCES: Pure substance, vapor-liquid-solid phase equilibrium in a pure substance, Independent properties of a pure substance, Equations of state for vapor phase of a simple compressible substance, Tables of thermodynamic properties, thermodynamic surfaces.

UNIT - V:

MIXTURES OF PERFECT GASES – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant, Molecular Internal Energy, Enthalpy, specific Heats and Entropy of Mixture of perfect Gases and Vapor.

UNIT - VI:

POWER CYCLES:

Otto, Diesel, Dual cycles, Stirling Cycle,– Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles, Brayton and Rankine cycles.

REFRIGERATION CYCLES:

Reversed Carnot cycle - Performance Evaluation, VCR system, Bell- Coleman cycle

TEXT BOOKS:

1. Thermodynamics an Engineering Approach by Yunus A. Cengel M. andMichael A. Boles, Seventh edition, McGraw Hill Education (India) Private Limited, 2011.
2. Engineering Thermodynamics by P.K.Nag, Fifth edition, Tata McGraw Hill Education Private Limited, 2012.

REFERENCES:

1. Fundamentals of Classical Thermodynamics by G.J.Van Wylen& Sonntag, 4th Edition, 1994 Wiley publication 2005.
2. Thermal Engineering by R.K. Rajput, 8th Edition, Lakshmi Publications
3. Engineering Thermodynamics by P.Chattopadhyay, Oxford Higher Edn Publications
4. Thermodynamics by J.P.Holman , McGrawHill.

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
FLUID MECHANICS							

COURSE OUTCOMES:

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

- **CO1: Analyze** the Fluid Properties and hydrostatic forces acting on different surfaces.
- **CO2: Apply** conversation laws to fluid flow problems in engineering applications.
- **CO3: Examine** basic laws of fluid dynamics and its application.
- **CO4: Determine** the dimensionless parameters and scaling laws to predict the prototype behavior.
- **CO5: Analyze** the different major and minor losses in the pipes.
- **CO6: Compute** theory of Boundary layer flows, Identifies dimensionless parameters.

UNIT - I:

PROPERTIES OF FLUIDS AND FLUID STATICS: Fluid properties: Mass density, specific weight, specific volume, specific gravity, viscosity, vapor pressure, compressibility, surface tension and capillarity.

Fluid statics: fluid pressure at a point, variation of pressure within a static fluid, hydrostatic law - Pressure head, Pascal's law, Measurement of pressure - Piezometric tube, U-Tube manometer, Differential U-Tube manometer, Inverted U-Tube manometer.

UNIT - II:

FLUID KINEMATICS: Lagrangian and Eulerian description of fluid flow: velocity and acceleration of fluid particles, different types of fluid flow, description of flow pattern: Stream line, streak line, path line. Principle of conservation of mass: Continuity equation, applications of continuity equation.

UNIT – III:

FLUID DYNAMICS: Euler's equation of motion along a stream line - Bernoulli's equation, Practical applications of Bernoulli's equation in flow measurement devices like venturimeter, orifice meter and Pitot tube, Concept of impulse momentum equation & angular momentum principle with applications.

UNIT – IV:

DIMENSIONAL AND MODEL ANALYSIS: Dimensional analysis: dimensions, dimensional homogeneity, methods of dimensional analysis-Buckingham Pi theorem, Raley's method Model analysis - Advantages and applications of model testing. Similitude, derivations of important dimensionless numbers, model laws.

UNIT - V:

FLOW THROUGH PIPES: Laminar and turbulent flow characteristics, laminar flow through circular pipes - Hagen Poiseuille law, major and minor losses in pipes, pipe friction, Darcy-Weisbach equation, parallel, series and branched pipes.

UNIT - VI:

BOUNDARY LAYER THEORY AND FLUID FLOW OVER BODIES: Boundary layer development on a flat plate and its characteristics - Boundary layer thickness, displacement thickness, momentum thickness, energy thickness. Momentum equation for boundary layer by vonkarman, drag on flat plate, boundary layer separation and its control. Aero foil theory, lift and drag coefficients, streamlined and bluff bodies.

TEXT BOOKS:

1. Fluid Mechanics and Hydraulics Machines by R.K.Bansal, Laxmi publications
2. Fluid Mechanics and Hydraulic Machines by R.K.Rajput, S. Chand Publications

REFERENCE BOOKS:

1. Fluid Mechanics by White.F.M, Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
2. Hydraulics and Fluid Mechanics by P.N.Modi and S.M.Sethi, Standard Book House, New Delhi.
3. Fluid Mechanics by Yunus A Cengel and John M. Cimbala, Tata McGraw Hill Edition, New Delhi, 2006.

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	-	4	40	60	100	3
MACHINE DRAWING AND CAD LAB							

COURSE OUTCOMES:

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

CO1: **Analyze** functionalities of various machine elements such as vices, bearings, screw jacks, shafts, fasteners, keys, cotters, pins, etc.

CO2: **Draw** full and half sectional views of machine parts using AUTOCAD.

CO3: **Draw** full and half sectional views of machine assemblies using AUTOCAD.

A.MACHINE DRAWING:

1. Introduction: full and half sectional views, limits, fits and tolerances.
2. Screwed fasteners: Screw thread nomenclature - types & classification of screw threads, Square & Hexagonal headed bolted joints.
3. Keys, Cotters and Pin joints: Saddle & Sunk Keys, Cotter Joint with sleeve, Knuckle Joint.
4. Assembly Drawings: Screw Jack, Tail Stock, Eccentric, Pipe vice, Plummer block.

B.C OMPUTER AIDED DRAFTING (CAD): using AUTO CAD

1. Introduction: Basic Drawing, Modify, editing & dimensioning commands, layers, AutoCAD - Screen Menus
2. Sectional views of castings
3. Assembly Drawings : (Any Two)
   a. Pipe vice, b. Tail Stock , c. Swivel Bearing, d. Screw Jack
4. Part Drawings : (Any Two)
   a. Single tool post
   b. Engine Connecting Rod
   c. Plummer block

TEXT BOOKS:

1. Machine Drawing by K.L.Narayana, P.Kannaiah & K.Venkata Reddy, New Age International, and 3rd Edition.
2. AutoCAD-14 for Engineering Drawing Made Easy by P.Nageswara Rao, TMH, 2010.

REFERENCE BOOKS:

1. Machine Drawing by K.R.Gopala Krishnan, Subhas Publications, 20th Edition, 2007.
2. An Introduction to AutoCAD 2000 by A.Yarwood, Longman Publishers

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB							

COURSE OUTCOMES:

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

CO1: **Determine** the efficiency of a Machines and Transformers and draw the performance curves of each.

CO2: **Draw** the no-load curve of a dc generator by calculating critical speed and critical resistance.

CO3: **Analyze** the diode and amplifier characteristics, Rectifier output waveforms.

Any five experiments are to be conducted from each part

SECTION A:

ELECTRICAL ENGINEERING:

1. Swinburne's test on D.C. Shunt machine (Predetermination of efficiency of a given D.C. Shunt machine working as motor and generator).
2. OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors).
3. Brake test on 3-phase Induction motor (Determination of performance characteristics).
4. Regulation of alternator by Synchronous impedance method.
5. Speed control of D.C. Shunt motor by
   a) Armature Voltage control b) Field flux control method
6. Brake test on D.C. Shunt Motor.

SECTION B:
ELECTRONICS ENGINEERING:

1. PN junction Diode characteristics
   Forward bias B. Reverse bias. (Cut in voltage & Resistance calculations)
2. Transistor CE Characteristics (Input and Output).
3. Full wave Rectifier with and without filters.
4. CE Amplifiers.
5. RC Phase Shift Oscillator.
6. Class A Power Amplifier.

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
MECHANICS OF SOLIDS & METALLURGY LAB							

COURSE OUTCOMES:

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

CO1: **Evaluate** the material properties of different materials through various destructive testing procedures.

CO2: **Examine** the microstructures of different ferrous and Non-Ferrous materials.

CO3: **Evaluate** the hardness values of different Ferrous and Non-Ferrous materials..

NOTE: Any 6 experiments from each section A and B.

(A) MECHNICS OF SOLIDS LAB:

1. Direct tension test-brittle and ductile materials
2. Fatigue Test
3. 3-point bend test
4. Unsymmetrical bend test
5. Specimen preparation and characterization
6. Torsion test
7. Vickers hardness Test
8. Test on springs
9. Compression test on cube
10. Impact test
11. Punch shear test
12. Brinell's and Rockwell's hardness test
13. Simply Supported beam

(B) METALLURGY LAB:

I. Preparation and study of the Micro Structure of Ferrous materials-

a) Cast Iron	**b) Steel**
1. Grey cast iron	4. Mild steel
2. Nodular cast iron	5. Low carbon steel
3. White cast iron	6. High carbon Steel

II. Preparation and study of the Micro Structure of Non-Ferrous materials-

7. Brass 8. Aluminium 9. Copper

10. Hardeneability of steels by Jominy End Quench Test.
11. Die penetration Test

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	-	-	-	-
VERBAL ABILITY							

COURSE OUTCOMES:

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

CO1: **Use** appropriate words effectively in their communication

CO2: **Identify** and correct Grammar and vocabulary related errors

CO3: **Construct** the sentences effectively using appropriate verbal reasoning abilities

CO4: **Demonstrate** understanding and comprehensive skills

UNIT - I:

Synonyms1, Synonyms2, Antonyms1, Antonyms2, One-Word Substitution, Phrasal Verbs, Idioms & Phrases, Word Family Operation, Commonly Confused words, Odd man out

UNIT – II:

Tenses, Voice, Parts of speech, Direct & Indirect Speech, Sentence Completion & Correction, Reconstruction of Sentences, Sentence Improvement, Choosing the Incorrect Sentences, Transformation

UNIT - III:

Common Errors1, Common Errors2, Common Errors3, Common Errors4, Common Errors5, Indianisms1, Indianisms2

UNIT - IV:

Direct / simple Analogy, Completing the analogous pair, choosing the Analogous pair, Double Analogy, Choosing a similar word, Detecting Analogies, Multiple-word Analogy

UNIT - V:

Reading Comprehension1, Reading Comprehension2, Reading Comprehension3, Reading Comprehension4, Cloze Passage1, Cloze Passage2, Cloze Passage3, Cloze Passage4

UNIT - VI:

Hidden Assumptions, Fallacies, Induction & Deduction Methods, Arguments, Truth, Validity, Soundness

TEXT BOOKS:

1. 30 Days to a More Powerful Vocabulary by Funk.
2. Practical English Usage by Michael Swan
3. Practice & Pass Professional: Verbal Reasoning Tests: Practice Questions and Expert Coaching to Help You Pass by Alan Redman
4. Kaplan MCAT Verbal Reasoning and Writing Review
5. The Verbal Reasoning Test Workbook: Unbeatable Practice for Verbal Ability by Mike Bryon
6. Understanding and Using English Grammar by Betty SchrampferAzar

REFERENCES:

1. http://www.verbalreasoningtest.org/
2. https://www.bond11plus.co.uk/verbal-reasoning
3. http://www.studyguidezone.com/mcat_verbalreasoning.htm
4. http://www.varsitytutors.com/mcat_verbal-practice-tests
5. https://www.khanacademy.org/test-prep/mcat

II B.TECH II SEMISTER

II B.Tech - II SEMESTER COURSE STRUCTURE

S.No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Business Management Concepts for Engineers	HS	4	-	-	40	60	100	3
2	Theory of Machines	PC	3	1	-	40	60	100	3
3	Applied Thermodynamics	PC	3	1	-	40	60	100	3
4	Hydraulic Machinery & Pneumatic Systems	ES	3	1	-	40	60	100	3
5	Manufacturing Technology	PC	4	-	-	40	60	100	3
6	Applied Thermodynamics Lab	PC	-	-	3	25	50	75	2
7	Manufacturing Technology Lab	PC	-	-	3	25	50	75	2
8	FM&HM Lab	ES	-	-	3	25	50	75	2
9	Mini Project-I	PRC	-	-	-	25	50	75	1
10	Quantitative Aptitude And Reasoning	MDC	3	-	-	-	-	-	-
	TOTAL		**20**	**3**	**09**	**300**	**500**	**800**	**22**

II B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
BUSINESS MANAGEMENT CONCEPTS FOR ENGINEERS							

COURSE OUTCOMES:

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

CO1: Analyze the fundamentals of Managerial economics for decision making
CO2: Importance of the various markets under production and cost analysis.
CO3: Apply the concepts of financial accounting and balance sheet with simple adjustments.
CO4: Evaluate fundamental concepts and principles of management.
CO5: Discuss functional areas of management like HR, marketing and finance.
CO6: Apply the project management techniques for project planning and evaluation

UNIT - I:

INTRODUCTION TO MANAGERIAL ECONOMICS: Definitions, Nature And Scope-Relation With Other Subjects- Demand- Definition- Determinants- Law of Demand and Its Exceptions- Concept of Elasticity of Demand-Demand Forecasting Techniques.

UNIT - II:

THEORY OF PRODUCTION AND COST ANALYSIS: Production Function- Law of Variable Proportions- Economies of Scale- Cost Concepts- CVP Analysis (With Simple Problems)-Significance- Limitations- Introduction to Markets – Features of various markets- Perfect competition, Monopoly and Oligopoly.

UNIT - III:

INTRODUCTION TO FINANCIAL ACCOUNTING: Definition-GAAP principles-types of accounting-Double entry system-Journal Entries-Ledger-Trail Balance-Income statement-Balance Sheet-Final Accounts with simple adjustments.

UNIT - IV:

INTRODUCTION TO MANAGEMENT: Concept, Nature, Importance- Functions of Management- Henry Fayols Principles of Management-F.W.Taylors Scientific Management-Douglas Mc Gregors Theory X and Y-Challenges of Management.

UNIT - V:

FUNCTIONAL ARES OF MANAGEMENT-1: Concept of HRM, Functions of HR Manager-Marketing Management- Functions of Marketing Manager- Production Management- Functions of Production Management- Methods of Production- Job production, Batch production and Mass Production –Method Study-Inventory Management-EOQ Analysis.

UNIT - VI:

FUNCTIONAL AREAS OF MANAGEMENT-2: Development of Network-Difference between PERT and CPM-Problems on Critical Path-Problems on PERT Analysis-Financial Management-Concepts of Capital-Working Capital-Capital Budgeting-Functions of Financial Management.

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TEXT BOOKS:

1. Managerial economics and financial analysis by Dr. N. APPARAO Dr. P. Vijay Kumar, Cengage Publications, New Delhi-2011
1. Managerial Economics and Financial Analysis by Dr. A. R. Aryasri, TMH Publications, 2011.
2. Managerial Science, Dr. P. Vijaya Kumar & Dr. N. AppaRao, Cengage publications New Delhi,2012.

REFERENCES:

1. Managerial Economies by V. Maheswari, Sultan Chand Publications.
2. Managerial Economics by Suma Damodaran, OxfordUniversity Press, 2011.
3. Essentials of Management by Koontz &Weihrich, TMH Publications, 2011 Strategic Management byHitt and Vijaya Kumar, Cengage learning.

II B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
THEORY OF MACHINES							

COURSE OUTCOMES:

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

CO1: **Discuss** the purpose of kinematics, kinematic joint & mechanism.
CO2: **Construct** the velocity and acceleration diagrams and the theories involved in cams and their working principles.
CO3: **Categorize** the cams and followers using different cases follower motions.
CO4: **Analyze** the stabilization of sea vehicles, aircrafts and automobile vehicles.
CO5: **Analyze** the working of governors and flywheels.
CO6: **Evaluate** the balancing of reciprocating and rotary masses.

UNIT – I:

MECHANISMS: 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. Gubralrs criteria, Grashoff's law, Degrees of freedom, Kutzbach criterian for planar mechanisms, Mechanism and machines –Classification of machines – kinematic chain – inversion of mechanism –inversion of mechanism – inversions of quadric cycle, chain – single anddouble slider crank chains.

UNIT – II:

KINEMATICS: Velocity and acceleration – Motion of a link in machine –Determination of Velocity and acceleration diagrams – Graphical method –Application of relative velocity method four bar chain. Velocity and acceleration analysis of a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration. Plane motion of body: Instantaneous center of rotation, centroids and axodes– relative motion between two bodies – Three centres in line theorem –Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – III:

CAMS: Definitions of cam and followers – their uses – Types of followers and cams– Terminology –Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above three cases. Analysis of motion of followers: Roller follower – circular cam with straight.

UNIT – IV:

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms.

UNIT - V:

GOVERNERS AND FLY WHEELS: Watt, porter and proell governors, spring loaded governors– Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms andhunting. Turning moment diagram, fly wheels and their design.

UNIT – VI:

GEAR: Higher pairs, friction wheels and toothed gears–types – law ofgearing, condition for constant velocity ratio for transmission of motion,velocity of sliding –phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact.

GEAR TRAINS: Introduction to gear Trains, Train value, Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio –Epicyclic gear trains.

TEXT BOOKS:

1. Theory of Machines by S.S.Ratan, Mc. Graw Hill Publ.
2. Theory of machines by Khurmi ,S.Chand publications

REFERENCES:

1. Theory of Machines by Sadhu Singh Pearsons Education
2. Theory of Machines by Thomas Bevan/ CBS
3. Mechanism and machine theory by Ashok G. Ambedkar, PHI Publications.

II B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
APPLIED THERMODYNAMICS							

COURSE OUTCOMES:

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

- **CO1: Compare** the reasons and effects of various losses that occur in the actual engine operation.
- **CO2: Distinguish** the various engine systems along with their function and necessity.
- **CO3: Analyz**e the combustion phenomenon and knocking in SI and CI Engines.
- **CO4: Evaluate** the performance and emission parameters of SI and CI engines.
- **CO5: Analyze** the working of different types of compressors.
- **CO6: Determine** the power and efficiency of reciprocating compressors and rotary compressors.

UNIT - I:

ACTUAL CYCLES AND THEIR ANALYSIS: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

UNIT - II:

WORKING OF I.C ENGINES: Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems -Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of Wankle engine, principles of supercharging and turbocharging

UNIT - III:

COMBUSTION IN S.I. ENGINES: Normal Combustion and abnormal combustion - Importance of flame speed and effect of engine variables - Type of Abnormal combustion, pre-ignition and knocking - Fuel requirements and fuel rating, anti knock additives -combustion chamber- requirements, types.

COMBUSTION IN C.I. ENGINES: Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT - IV:

MEASUREMENT, TESTING AND PERFORMANCE: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power - Performance test – Heat balance Sheet

UNIT - V:

COMPRESSORS: Classification - positive displacement and roto dynamic machinery - power producing and power absorbing machines, fan, blower and compressor-positive displacement and dynamic types-reciprocating and rotary types.

Rotary (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor - Mechanical details and principle of working - efficiency considerations.

UNIT-VI:

ROTARY COMPRESSORS: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

AXIAL FLOW COMPRESSORS: Mechanical details and principle of operation –velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency-pressure rise calculations – Polytrophic efficiency.

TEXT BOOKS:

1. Internal Combustion Engines by V.Ganesan, Tata McGraw Hills Publications
2. A treatise on heat power engineering by Vasandani & D.S.Kumar, Metropolitan Book Co. Ltd.

REFERENCES:

1. Internal Combustion Engine by M.L.Mathur and R.P.Sharma, DhanpatRai Publications
2. Thermal Engineering by R.S.Khurmi and J.K.Guptha, S.Chand Publicationss

II B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
HYDRAULIC MACHINERY AND PNEUMATIC SYSTEMS							

COURSE OUTCOMES:

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

CO1: **Determine** the force required to move the vane using water jet
CO2: **Analyze** the working principle of turbines and its applications
CO3: **Evaluate** the operating conditions of Centrifugal and Reciprocating pumps.
CO4: **Categorize** the Hydraulic Valves and Hydraulic System Accessories
CO5: **Analyze** the Pneumatic systems and control valves
CO6: **Develop** the single and multiple Actuator Circuits by using Cascade method.

UNIT - I:

BASICS OF TURBO MACHINERY: Hydrodynamic force or jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes

UNIT - II:

HYDRAULIC TURBINES: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine – working proportions, work done, efficiencies, hydraulic design-draft tube-theory-functions and efficiency.

UNIT - III:

CENTRIFUGAL PUMPS: Classification, working, work done - manometric head losses and efficiencies, specific speed- pumps in series and parallel-performance characteristic curves, NSPH; Reciprocating pumps: Working, Discharge, Slip, Indicator diagrams

UNIT - IV:

HYDRAULIC VALVES AND HYDRAULIC SYSTEM ACCESSORIES: Basic principles of hydraulics, Direction control valves, Pressure control valves, Flow control valves, Non-return valves, Reservoirs, Accumulators, Heating & cooling devices, Hoses. Selection of valves for circuits.

UNIT - V:

INTRODUCTION TO PNEUMATIC SYSTEMS: Basic requirements for pneumatics systems, Applications, Pneumatic fundamentals, Construction, Working principle and operation of pneumatic power transmission system components, FRL unit, Actuators and control valves - DCV, FCV, PCV, time delay, quick exhaust, twin pressure, shuttle

UNIT - VI:

PNEUMATIC CIRCUITS: Basic pneumatic circuits, Development of single Actuator Circuits, Development of multiple Actuator Circuits, Cascade method for sequencing, introduction to piping and its software's.

TEXTBOOKS:

1. Hydraulics, Fluid Mechanics and Hydraulic Machinery by P.N. Modi, S.M. Seth, Standard Book House Fluid Mechanics and Hydraulic Machines by R.K.Rajput, S. Chand *Publishing*
2. Industrial Hydraulics by John Pippenger and Tyler Hicks, McGraw Hill.
   Basic Pneumatic Systems, Principle and Maintenance by S R Majumdar, McGraw Hill.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S.Kumar, SK Kataria and Sons.
2. Fluid Power with Applications by Anthony Esposito, Pearson.
3. Hydraulic and Pneumatic Controls: Understanding made Easy by K.Shanmuga Sundaram, S.Chand, New Delhi, 2006.

II B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
MANUFACTURING TECHNOLOGY							

COURSE OUTCOMES:

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

CO1: **Analyze** different manufacturing processes and fundamentals of casting.
CO2: **Distinguish** different types of furnaces and design gating system for preparation of a casting.
CO3: **Identify** appropriate type of welding process for fabrication of metals.
CO4: **Analyze** the process details of advanced welding processes.
CO5: **Categorize** the characteristics of cold and hot working processes.
CO6: **Discuss** the principles of sheet metal working, plastic injection and blow moulding processes.

UNIT - I:

Introduction to Manufacturing Processes, Difference between Production and Manufacturing. **FOUNDRY:** Introduction to casting process, steps involved in making a casting, Advantages of casting and its applications, Types of patterns, Materials used for patterns, Pattern allowances, sand moulding procedure, Moulding materials, Importance of constituents, Cores, Types of Sand moulding-CO_2 Moulding and Shell Moulding.

UNIT - II:

GATING SYSTEM: Elements of gating system, Gating system design, Calculation of gating system dimensions for simple objects, riser design and its function, Solidification of casting.
SPECIAL CASTING METHODS: Permanent Mould Casting, Die Casting, Centrifugal Casting, Investment Casting, Continuous Casting, Fettling of Castings, Casting Defects: causes and remedies.

UNIT - III:

WELDING: Classification of welding processes, Types of welds and types of joints.
GAS WELDING: Equipment, Oxy-Acetylene flame, types, Gas welding procedure, Gas cutting. **ARC WELDING:** Principle of Arc welding, Equipment, Electrodes, Electrode coatings, AC and DC Welding, Arc Blow, Arc Length Characteristics, Related Simple Problems. Welding defects- Causes and Remedies.

UNIT - IV:

RESISTANCE WELDING: Principle, Butt welding, spot welding and seam welding. Simple problems on resistance welding.
OTHER WELDING PROCESSES: Thermit welding, Inert gas welding - TIG and MIG welding, submerged arc welding, plasma arc welding, soldering and brazing.

UNIT - V:

FORMING AND FORGING: Fundamentals, Introduction to metal working process, Hot working, Cold working.
ROLLING: Rolling fundamentals, Analysis of rolling process- Derivation of Length of deformation zone, Angle of bite, Maximum reduction possible for one pass, Rolling stand arrangements.

UNIT - VI:

EXTRUSION & DRAWING: Extrusion fundamentals, Classification of Extrusion- Forward Extrusion, Backward Extrusion, Impact extrusion, Hydrostatic extrusion. Types of drawing: Wire drawing, Tube drawing.

TEXT BOOKS:

1. Manufacturing Technology Vol-I by P.N. Rao, Tata McGraw Hill Publications.
2. Production Technology by P. C. Sharma, S. Chand Publications.

REFERENCES:

1. Welding Technology by Little by Tata McGraw Hill Publications.
2. Manufacturing Engineering and Technology by Kalpak Jain, Pearson Education/PHI.

II B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
APPLIED THERMODYNAMICS LAB							

COURSE OUT COMES:

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

CO1: Estimate the performance and efficiency of IC engines at various horse powers.
CO2: Determine the calorific value of fuel using Bomb Calorimeter.
CO3: Evaluate the performance and efficiency of for compressors

LIST OF EXPERIMENTS:

1. Determination of flash point, fire point.
2. Determination of calorific value of fuel using Bomb Calorimeter.
3. Determination of viscosity of fluid.
4. I.C. Engine Valve Timing Diagram
5. I.C. Engine Port Timing Diagram
6. I.C. Engine Performance Test on Single Cylinder 4 Stroke Diesel Engine
7. Evaluation of Engine Friction by Conducting Morse Test on 4 - Stroke Petrol Engine.
8. Evaluation of Engine Friction by Conducting Motoring/Retardation Test on Single Cylinder 4 Stroke Diesel Engine
9. Heat Balance Test on Single Cylinder 4 Stroke Diesel Engine
10. Performance Test on Variable Compression Ratio
11. Volumetric Efficiency of a Reciprocating Air Compressor
12. Disassembly/Assembly of I.C. Engine

II B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
MANUFACTURING TECHNOLOGY LAB							

COURSE OUTCOMES:

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

CO1: **Make** use of green sand mould for single-piece and multi-piece patterns.
CO2: **Experiment** with electric arc, spot, and gas welding techniques to make joints.
CO3: **Model** plastic parts using injection and blow moulding.

LIST OF EXPERIMENTS:

I. MOLDING PRACTICE:

1. Preparation of a green sand mould using single piece pattern.
2. Preparation of a green sand mould using multi piece pattern.
3. Sand testing: green strength, dry strength, grain fineness number, permeability etc.

II. WELDING PRACTICE:

1. Preparation of a T joint using electric arc welding.
2. Preparation of a Butt Joint using gas welding.
3. Preparation of a lap joint using spot welding.

III. PLASTIC MOLDING:

INJECTION MOLDING:

4. Preparation of a key chain by using two plate mold.

BLOW MOLDING:

5. Preparation of a bottle by using blow molding technique.

IV. MECHANICAL PRESSES:

6. Preparation of a rod bends using hydraulic press.
7. Preparation of a washer using hydraulic press.

V. DEMONSTRATION OF STIR CASTING MACHINE:

8. Preparation of Aluminum casting with stir casting machine

II B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
FLUID MECHANICS & HYDRAULIC MACHINERY LAB							

COURSE OUTCOME:

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

CO1: **Experiment** with the flow discharge measuring devices used in pipes, channels and tanks.
CO2: **Solve** the flow equations to estimate performance of the Turbines and Pumps
CO3: **Determine** the friction factor and loss of head of a pipe flow.

LIST OF EXPERIMENTS:

1. Impact of jet on Vane.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head in a pipe flow
12. Pneumatic trainer.

II B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	-	-	-	-
QUANTITATIVE APTITUDE AND REASONING							

COURSE OUTCOMES:

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

CO1: Prepare well for clearing Quantitative Aptitude and Reasoning tests for campus placements.

CO2: Evaluate various real life situations by resorting to Analysis of key issues and factors.

CO3: Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.

CO4: Solve complex mathematical problems in the shortest time possible by applying shortcuts.

UNIT – I:

SIMPLE EQUATIONS: Definition of Linear Equations, Formation of simple equations, Problems on Ages, Fractions and Digits, Indeterminate system of equations, Special cases in indeterminate system of equations

RATIO AND PROPORTION: Definition of Ratio, Properties of Ratios, Comparison of Ratios, Problems on Ratios Compound Ratio, Problems on Proportion, Mean proportional and Continued Proportion

VARIATION: Direct variation, Inverse variation, Joint variation, Problems on Variations

UNIT – II:

PERCENTAGES: Introduction, Converting a percentage into decimals, Converting a Decimal into a percentage equivalent of fractions, Problems on percentages

PROFIT AND LOSS: Problems on Profit and Loss percentage, Relation between Cost Price and Selling price, Discount and Marked Price, Two different articles sold at same Cost Price, Two different articles sold at same Selling Price, Gain% / Loss% on Selling Price

PARTNERSHIP: Introduction, Relation between capitals, Period of investments and Shares

SIMPLE INTEREST: Definitions, Problems on interest and amount, Problems when rate of interest and time period are numerically equal.

COMPOUND INTEREST: Definition and formula for amount in compound interest, Difference between simple interest and compound interest for 2 years on the same, principle and time period

QUADRATIC EQUATIONS: General form of Quadratic equations, Finding the roots of Quadratic equations, Nature of the roots, Relation between the roots, Maximum and minimum value of Quadratic Expression.

PROGRESSIONS: Arithmetic Progression, Geometric Progression, Harmonic Progression, Arithmetic Mean, Geometric Mean and Harmonic Mean and their relation.

UNIT – III:

DEDUCTIONS: Finding the conclusions using Venn diagram method, Finding the conclusions using syllogism method.

CONNECTIVES: Definition of a simple statement, Definition of compound statement,finding the Implications for compound statements, Finding the Negations for compound statements.

UNIT – IV:

TIME AND DISTANCE: - Relation between speed, distance and time, Converting km/h into m/s and vice versa, Problems on average speed, Problems on relative speed, Problems on trains, Problems on boats and streams, Problems on circular tracks, Problems on races

TIME AND WORK: - Problems on Unitary method, Relation between Men, Days, Hours and Work, Problems on Man-Day-Hours method, Problems on alternate days, Problems on Pipes and Cisterns

UNIT – V:

ANALYTICAL REASONING PUZZLES: Problems on Linear arrangement, Problems on Circular arrangement, Problems on Double line-up, Problems on Selections, and Problems on Comparisons

UNIT – VI:

CLOCKS: Finding the angle when the time is given, Finding the time when the angle is known, Relation between Angle, Minutes and Hours, Exceptional cases in clocks

CALENDARS: Definition of a Leap Year, Finding the number of Odd days, framing the year code for centuries, Finding the day of any random calendar date.

BLOOD RELATIONS: Defining the various relations among the members of a family, Solving Blood Relation puzzles, solving the problems on Blood Relations using symbols and notations

TEXT BOOKS:

1. Thorpe's verbal reasoning by LSAT Materials by GL Barrons, McGraw Hills,
2. A modern approach to Logical reasoning by R S Agarwal,S.Chand
3. Quantitative Aptitude by R S Agarwal, S Chand
4. Quantitative Aptitude by G. L BARRONS
5. Quantitative Aptitude by AbhijitGuha, McGraw Hills

REFERENCES:

1. www.careerbless.com/aptitude/qa/home.php
2. www.affairscloud.com/quantitative-aptitude-questions
3. www.careerafter.com/rs-aggarwal-quantitative-aptitude-pdf/
4. www.amazon.in/Quantitative-Aptitude-Competitive-Examinations.../8121924987
5. www.indiabix.com
6. www.practiceaptitudetests.com/numerical-reasoning-tests

III B.TECH I SEMISTER

III B.Tech - I SEMESTER COURSE STRUCTURE

S.No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Metal Cutting & Machine Tools	PC	4	-	-	40	60	100	3
2	Heat Power Engineering	PC	3	1	-	40	60	100	3
3	Machine Dynamics & Vibrations	PC	3	1	-	40	60	100	3
4	Principles of Machine Design	PC	3	1	-	40	60	100	3
5	Operations Research	BS	3	1	-	40	60	100	3
6	Open Elective-I (See the List of Open Electives)	OE	4	-	-	40	60	100	3
7	Heat Power Engineering Lab	PC	-	-	3	25	50	75	2
8	Machine Tools & Machine Dynamics Lab	PC	-	-	3	25	50	75	2
9	Advanced Communication Skills (Mandatory Non Credit Course)	MDC	3	-	-	-	-	-	-
10	Sports and Games (Mandatory Non Credit Course)	MDC	-	-	2	-	-	-	-
	TOTAL		**23**	**4**	**08**	**290**	**460**	**750**	**22**

III B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
METAL CUTTING & MACHINE TOOLS							

COURSE OUT COMES:

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

CO1: **Identify** different cutting tool materials, tool nomenclature and calculate cutting parameters to enhance tool life.
CO2: **Analyze** the construction & specification of various lathe machines.
CO3: **Distinguish** the working of Shaping, slotting, planning, drilling, boring machines.
CO4: **Analyze** the construction & specification of milling machines.
CO5: **Distinguish** the working of grinding, lapping, honing and broaching processes.
CO6: **Discuss** the Principles of jigs and fixtures.

UNIT – I:

FUNDAMENTALS OF MACHINING: Elementary treatment of metal cutting theory -element of cutting process – geometry of single point tool angles, chip formation and types of chips – built-up edge and its effects chip breakers, mechanics of orthogonal cutting – Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, coolants, tool materials**.**

UNIT–II:

LATHE MACHINES: Engine lathe – principle of working, specification of lathe – types of lathe, taper turning and methods, thread turning, constructional features of speed gear box and feed gear box. Turret and capstan lathes, work holders, tool holding devices. Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes, lathe attachments, Machining time calculations.

UNIT–III:

SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working–principal parts – specifications, operations performed, machining time calculations. **DRILLING & BORING MACHINES:** Twist drill and its geometry, principles of working, specifications, types, operations performed, Boring Machines – fine Boring Machines – jig boring machine, Deep hole drilling Machine, machining time calculations.

UNIT –IV:

MILLINGMACHINES: Principles of working – specifications – classification of Milling Machines – Principle features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, methods of indexing, machining time calculations.

UNIT–V:

FINISHING PROCESSES: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations.

UNIT–VI:

JIGS & FIXTURES: Principles of jigs and fixtures, uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, drill jigs and milling and boring fixtures.

TEXT BOOKS:

1. Manufacturing technology II, P.N Rao, Tata Mcgraw hill publishers
2. Workshop Technology, B.S.RagVamshi–Vol II, DhanpatRai& Co

REFERENCES:

1. Production Technology by H.M.T., Tata McGraw-Hill Education
2. Production Engineering, K.C Jain & A.K Chitaley, PHI Publishers
3. Production Technology, R.K. Jain and S.C. Gupta, Khanna Publisher

III B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
HEAT POWER ENGINEERING (Use of steam tables and Mollier chart is allowed)							

COURSE OUTCOMES:

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

- **CO1: Improve** the performance, regeneration & reheating of a Rankine Cycle
- **CO2: Categorize** the various boilers and draught.
- **CO3: Identify** the different types of nozzles used in steam turbines.
- **CO4: Categorize** the steam turbines based on utility and applications.
- **CO5: Measure** the flow, pressure, temperature of a steam.
- **CO6: Discuss** gas turbines, jet propulsion and rocket propulsion.

UNIT – I:

RANKINE CYCLE: Schematic layout, thermodynamic analysis, methods to improve cycle performance, regeneration & reheating.

COMBUSTION: Fuels and combustion, concepts of heat reaction, adiabatic flame temperature, flue gas analysis.

UNIT - II:

BOILERS: Classification, working principles of L.P & H.P boilers, mountings and accessories, working principles, boiler horsepower, equivalent evaporation, efficiency.

DRAUGHT: Classification, Natural and Artificial draught, induced and forced draught, height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney.

UNIT – III:

STEAM NOZZLES: Function of a nozzle, applications, types, flow through nozzles, thermodynamic analysis, assumptions, velocity of fluid at nozzle exit, Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, nozzle design, Super saturated flow, its effects, degree of super saturation and degree of under cooling, Wilson line.

UNIT - IV:

STEAM TURBINES: Construction & working of steam turbines, Impulse & reaction principles, inlet & outlet velocity diagrams. Work output & efficiencies. Pressure & velocity compounding, regenerative feed water heating, reheat cycles, reheat factor, governing of turbine, back pressure & pass out turbine.

UNIT - V:

STEAM INSTRUMENTATION AND CONTROLS: Steam flow measurement, water and steam pressure measurements, superheated steam temperature control, steam pressure control, smoke detectors, and pollution monitoring instruments.

STEAM CONDENSERS: Types, cooling water requirement, air leakage and air pump capacity, vacuum and condenser efficiencies, steam ejectors, spray pond, cooling tower.

UNIT – VI:

GAS TURBINES: Simple gas turbine plant, ideal cycle, essential components, parameters of performance, actual cycle, regeneration, inter-cooling and reheating, closed and semi-closed cycles, merits and demerits and types of combustion chambers.

JET PROPULSION: Working principle, thrust power, propulsive force and efficiency.

ROCKET ENGINE: Theory of operation and its applications, propellant and types.

TEXT BOOKS:

1. Thermodynamics and Heat Engines, Volume 2, R.Yadav, Centralbook depot.
2. Heat Engineering, V.P Vasandani and D.S Kumar, MetropolitanBook Company, New Delhi

REFERENCES:

1. Gas Turbines and Propulsive Systems, P.Khajuria & S.P.Dubey, Dhanpatrai
2. Gas Turbines, Cohen, Rogers and SaravanaMuttoo, Addison Wesley, Longman, John wiley& sons
3. Thermal Engineering, R.S Khurmi, JS Gupta, S.Chand, Mechanical Engineering

III B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
MACHINE DYNAMICS AND VIBRATIONS							

COURSE OUTCOMES:

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

CO1: **Determine** the friction effect on Inclined plane, screw and nuts, pivot and collar bearings.
CO2: **Determine** the friction effect on disc, multi plate, cone and centrifugal clutches.
CO3: **Categorize** the brakes and dynamometers.
CO4: **Analyze** the balancing of rotating and reciprocating masses by analytical and graphical methods.
CO5: **Determine** the natural frequency of free longitudinal vibrations of systems by using energy principles.
CO6: **Determine** Natural frequency of free transverse vibrations over a shaft under Point loads, uniform distributed load and several loads using Dunkerley's method and energy methods.

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UNIT - I:

FRICTION: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, and film lubrication.

UNIT – II:

FRICTION CLUTCHES: Basics, Inclined planes, Screw thread forms (Square, V), Screw jack, Rolling friction, Journal friction. Friction axis of a link, four-bar mechanism, film friction.Pivots and collars, uniform pressure, uniform wear. Types of clutches –disc, multi plate, cone and centrifugal

UNIT – III:

BRAKES AND DYNAMOMETERS: Types of brakes – Block brake, band brake, disc brake, and block brake, internal expanding shoe brake, effect of brake. Types of dynamometer-Prony, rope brake

UNIT – IV:

BALANCING: Introduction, Static balancing, dynamic balancing, balancing of several masses in same planes, balancing of several masses in different planes, Balancing of Reciprocating masses, balancing of locomotives, balancing of inline engines, balancing of V-engines.

UNIT – V:

MECHANICAL VIBRATIONS: Introduction**,** Definitions, types, basic features, degrees of freedom. Types of vibrations- Natural frequencies of free longitudinal vibrations of systems having single degree of freedom Free longitudinal vibration – equilibrium method, energy method, Rayleigh's method, Displacement, velocity, acceleration, effect of mass of spring, damped vibration, logarithmic decrement. Forced longitudinal vibrations- harmonic excitation, magnification factor, vibration isolation and transmissibility, rotating imbalance, support excitation

UNIT – VI:

TRANSVERSE AND TORSIONAL VIBRATIONS: Transverse vibrations, single concentrated load, uniformly distributed load, several loads, Dunkerley's method, energy method, whirling of shafts. Torsional vibrations -single rotor, two-rotor, three-rotor systems, torsionally equivalent shaft, geared system. Frequency of damped vibration with damping-magnification factor or dynamic magnifier.

TEXT BOOKS:

1. Theory of machines, SS Rattan, Tata McGraw Hill publications.
2. Mechanical Vibrations, G.K.Groover, Nem Chand and bros.

REFERENCES:

1. Theory of Machines, Thomas Bevan, Pearson education publications.
2. Theory of Machines, W.G.Green, Blackie publications.
3. Theory of Machines, R.S. Khurmi&J.K.Gupta, S. Chand Publications.

III B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
PRINCIPLES OF MACHINE DESIGN (Design Data Hand Book Is Not Allowed)							

COURSE OUTCOMES:

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

CO1: **Analyze** the design considerations and stresses in machine members.
CO2: **Solve** the problems related to strength of machine elements.
CO3: **Apply** the engineering principles for the design of simple engineering machine members such as riveted joints, welded joints.
CO4: **Distinguish** the different design parameters for keys, cotters, knuckle joints and power transmission of joints.
CO5: **Solve** the problems by using design parameters of shaft coupling for different application.
CO6: **Determine** the strength of different springs under expansion and compression.

UNIT – I:

INTRODUCTION: General considerations in the design of Engineering Materials and their properties selection –Manufacturing consideration in design, tolerances and fits –BIS codes of steels.

STRESSES IN MACHINE MEMBERS: Simple stresses combined stresses, torsional and bending stresses, impact stresses, stress strain relation, various theories of failure, factor of safety, design for strength and rigidity, preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations, static strength design based on fracture toughness.

UNIT – II:

STRENGTH OF MACHINE ELEMENTS:

Stress concentration, theoretical stress concentration factor, fatigue stress concentration factor notch sensitivity, design for fluctuating stresses, endurance limit, estimation of endurance strength, Soderberg's line, Goodman's line, modified Goodman's line.

UNIT – III:

RIVETED AND WELDED JOINTS: Riveted joints- types, failure of joints, and efficiency of joint. Welded joints-types of welded joints, strength of butt, parallel fillet and transverse fillet welded joints Stresses, joints subjected to bending and twisting moments.

UNIT – IV:

KEYS, COTTERS AND KNUCKLE JOINTS: Types of keys, force acting on keys, Design of Keys. Types of Cotter joint-Socket & Spigot joint, Sleeve & Cotter joint, Knuckle Joint.

POWER TRANSMISSION SHAFTS: Design of shafts. Shafts subjected to bending, torsion and axial loading. Shafts subjected to Fluctuating loads.

UNIT – V:

SHAFT COUPLING: Rigid couplings-muff, split muff and flange couplings, flexible couplings-flange coupling (modified).

UNIT – VI:

MECHANICAL SPRINGS: Stresses and deflections of helical springs, extension and compression of springs, springs for fatigue loading, energy storage capacity, helical torsion springs, co-axial springs, leaf springs.

TEXT BOOKS:

1. Design of Machine Elements,V.B.Bhandari, TMH Publishing Co. Ltd., New Delhi.
2. Mechanical Engineering Design,J.E.Shigley, TMH Publishing Co. Ltd., New Delhi.

REFERENCES:

1. Machine Design, Pandyah and Shah, TMH Publishing Co. Ltd., New Delhi.
2. Design Data hand book. Mahadevan, CBS Publishers.
3. Machine Design, R.S. Khurmi & J.K.Gupta, S. Chand Publications.

III B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
OPERATIONS RESEARCH							

COURSE OUTCOMES:

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

CO1: **Formulate** the linear programming problems by using graphical solution, simplex method, artificial variables techniques, two–phase method, and big-M method.
CO2: **Formulate** the transportation, assignment problems by using different methods.
CO3: **Evaluate** sequencing and networking problems.
CO4: **Evaluate** waiting line theory problems with infinite population and finite population models.
CO5: **Solve** game theory problems with saddle points and without saddle points.
CO6: **Analyze** the replacement and simulation problems..

UNIT – I:

Development-definition, characteristics and phases, types of operation research models, applications.

LINEAR PROGRAMMING PROBLEM: Formulation, graphical solution, simplex method, artificial variables techniques, two–phase method, big-M method, duality principle.

UNIT – II:

TRANSPORTATION PROBLEM: Formulation, types of initial basic feasible solution using different methods, optimal solution, unbalanced transportation problem, degeneracy.

ASSIGNMENT PROBLEM: Formulation, optimal solution, variants of assignment problem, travelling salesman problem.

UNIT – III:

SEQUENCING: Introduction, flow, shop sequencing, *n* jobs through two machines, *n* jobs through three machines, job shop sequencing, and two jobs through 'm' machines.

NETWORKING MODELS: Earliest Completion time of a project and Critical path, Programme Evaluation Review Technique, Total Slack, Free Slack, Probability of achieving completion date, Cost Analysis, Crashing the network, Resource Scheduling-Advantages, Limitations, Cost Analysis, Distinction between PERT and CPM, LPP Formulation

UNIT – IV:

WAITING LINES: Introduction – single channel – poison arrivals –exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals.

UNIT – V:

THEORY OF GAMES: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 &2 x n games -graphical method.

UNIT – VI:

REPLACEMENT: Replacement Model, Replacement of items that deteriorate, Gradually, Fail suddenly, group Replacement policy analysis, Problems.

SIMULATION: Definition, types of simulation models, phases of simulation, applications of simulation, inventory and queuing problems, advantages and disadvantages, simulation languages.

TEXT BOOKS:

1. Operations Research, S.D.Sharma, KedarNath Ram Nath Publishers.
2. Operations Research, A.M.Natarajan, P.Balasubramani and A. Tamilarasi, Pearson Education.

REFERENCES:

1. Introduction to O.R, Hiller & LibermannTata McGraw Hill
2. Operations Research, R.Pannerselvam,PHI Publications.
3. Operations Research, Wagner, PHI Publications.

III B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
OPEN ELECTIVE-I ELEMENTS OF MECHANICAL ENGINEERING							

COURSE OUTCOMES:

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

CO1: Analyze about mechanical fasteners and applications.
CO2: Analyze the Soldering and Brazing processes
CO3: Analyze about the casting process.
CO4: Categorize different machine tool operations.
CO5: Discuss about fire hazards and first aid and safety.
CO6: Analyze the automobile components and features**.**

UNIT – I:

MECHANICAL FASTENERS: Types of mechanical fasteners-screw bolts, nuts and rivets – Classification, Bolts and nuts- different types of nuts used in the industry- Purpose of washers- Different types of screw threads– Riveting and advantages of riveting- Applications of rivets- Electrical connections-Use of adhesives for joining- advantages of joining parts by using adhesives- Demerits of adhesives.

UNIT – II:

SOLDERING, BRAZING: Soldering- Use of flux in soldering- heating requirements in the soldering process- types of soldering joints- Metals and their mix ratios used in producing solder alloys- Eutectic point of metals- Electrical soldering and Plumber soldering- Brazing and alloys used for brazing- Brass and Silver Brazing- Fluxes used in Brazing- Applications of Brazing.

UNIT – III:

CASTING: Steps involved in making a casting, Advantages and applications, moulding sand and its properties, Patterns and Pattern making, pattern allowances, sand casting, die casting, casting defects

UNIT – IV:

MACHINE TOOLS: Lathe classification-wood turning, engine lathe, speed lathe, capstan and turret lathe, special purpose lathe specifications, and operations- turning, facing, taper turning, thread cutting, knurling.

UNIT – V:

MODERN MATERIALS: Nanomaterials and composites, super hard materials, photonics, permanent magnet materials, superconductors, semiconductors, materials for information storage, smart materials, materials for clean energy, polymers ,biomaterials

SENSORS: Magnetic sensors, Humidity sensors, Proximity sensors, Position sensors, Optical sensors, Thermal sensors,

UNIT – VI:

AUTOMOBILE ENGINEERING: Safeties in automobile-seat belt, airbags, wind screen, bumper, suspension sensors.

ADVANCES IN AUTOMOBILE ENGINEERING: Anti-lock braking, power windows, traction control, mirrors, central locking.

TEXT BOOKS:

1. Elements of Mechanical Engineering, A.R.Asrani, S.M.Bhatt and P.K.Shah B.S.Publishers.
2. Elements of Mechanical Engineering, M.L.Mathur, F.S.Metha and R.P.Tiwari, Jain Brothers Publs.2009.

REFERENCES:

1. Production Technology, P.N.Rao, Tata McGraw Hill publications
2. Automobile Engineering by Dr. Kirpal Singh, Standard Publishers.
3. Electrical and Electronics Engineering Materials by SK Bhattachary, Khanna publishers, New Delhi.

III B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
OPEN ELECTIVE-I MATERIAL SCIENCE							

COURSE OUTCOMES:

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

CO1: Analyze the properties of engineering materials.
CO2: Analyze details about insulating materials.
CO3: Discuss the properties of magnetic materials.
CO4: Analyze the basic concepts of special materials and their applications.
CO5: Evaluate the nano materials properties and their engineering applications.
CO6: Analyze basic concepts of shape memory alloys.

UNIT – I:

CLASSIFICATION OF MATERIALS: Atomic structure of the atom- Electronic structure of the atom-Energy band diagram- Types of materials-Conductors-Insulators & Semiconductors-Effect of impurities-Metals commonly used in Electrical and Electronics – Mechanicals properties of materials- Electrical and mechanical & General properties of Copper- Mechanical properties of steel- Uses od different conductors in electronics engineering- Corrosion and methods to prevent corrosion - Anodization of Aluminium.

UNIT – II:

INSULATING MATERIALS: Insulating Materials – Electrical properties of Insulating materials- Insulating resistance, Volume and Surface resistance – factors affecting Insulating materials on the basis of the temperature like Y,A,E,B,F,H,C Class- Properties of Impregnated paper, Wood , Cardboard, Asbestos, Mica, Ceramics and Glass and uses of these insulating materials- Thermoplastic & Thermoplastic resins – Properties & applications of PVC.

UNIT – III:

MAGNETIC MATERIALS: Magnetic Materials- Classification- Ferromagnetic, Paramagnetic, Diamagnetic and Ferromagnetic – Soft and Hard magnetic materials- important magnetic materials used in the electrical and electronic industry- properties of magnetic materials- effect of temperature on magnetism- curie point- hysteresis and hysteresis loss- use of soft magnetic materials like silicon sheet steel for transformers- merits of cold rolled grain oriented steels for transformer

UNIT – IV:

SPECIAL MATERIALS: Alloys- important alloys used in electrical engineering- low resistivity copper alloys: Brass, Bronze- Use of cadmium copper and beryllium copper- Alloys used for Bimetallic strips, soldering and fuse material- Combination alloys of manganin, constantin, Nichrome and solder material and their uses – Uses of Nickel-Iron alloys- ceramic material-Applications of ceramic materials in the electrical engineering- Ferrites- important properties of ferrites- composition of Neodymium- applications of Neodymium magnets- Superconductivity phenomenon-superconducting metals- applications of superconductivity.

UNIT – V:

NANO MATERIALS: Nano material Definition, Classification of Nanostructured materials, cause of interest in nanomaterial, some present and future applications of nano materials, special nano materials: Carbon nano tubes, properties and applications.

UNIT – VI: FUNCTIONALLY GRADIENT MATERIALS

Chemical Composition Gradient Functionally Gradient Materials, Porosity Gradient Functionally Gradient Materials, Microstructure Gradient Functionally Gradient Materials, Application of Functionally Graded Materials.

TEXT BOOKS:

1. Material science for Electrical and Electronics engineers by Ian Jones. Oxford University Press 2007.
2. Micro manufacturing and nanotechnology by M.S. Ramachandra Rao, Wiley publications.
3. "Nano Materials" Bandyopadhyay A.K. New Age International Publishers

REFERENCES:

1. Electrical and Electronics Engineering Materials by SK Bhattachary, Khanna publishers, New Delhi.
2. Engineering material properties and selection by Kennith G.Budiniski, Prentice Hall, New Delhi.

III B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
HEAT POWER ENGINEERING LAB							

COURSE OUTCOMES:

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

CO1: **Determine** the various horse powers, Calorific values, emissions of IC engines.

CO2: **Determine** the various efficiencies and energy balance for several types of Internal Combustions Engines and compressors.

CO3: **Categorize** the different types of boilers and solar flat plate collectors**.**

LIST OF EXPERIMENTS:

1. Determination of Calorific Value of gaseous Fuel by Junker's Calorimeter.
2. Performance Analysis of Heat Pipe
3. Engine Performance with Turbo Charger & without Turbo Charger
4. Emission Studies of IC Engine.
5. Performance Analysis of Vapour Compression Test Rig
6. Economical Speed Test on Four Stroke Multi-cylinder Petrol Engine
7. Performance Test on Solar Flat Plate Collector Test Rig
8. Retardation Test on Single Cylinder Diesel Engine.
9. Study of Boilers.
10. Dryness fraction measurement by separating and throttling calorimeter.

III B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
MACHINE TOOLS AND MACHINE DYNAMICS LAB							

COURSE OUTCOMES:

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

CO1: **Make** use of lathe, shaper, planer, drilling, milling and grinding machines for different machining operations.

CO2: **Determination** of the magnitude and orientation of the balancing mass in static and dynamic balancing.

CO3: **Determination** of the magnitude of gyroscopic couple, angular velocity of precession, and representation of vectors.

PART-A
MACHINE TOOLS LAB

LIST OF EXPERIMENTS:

1. Experiment on Plain turning and step turning operation.
2. Experiment on taper turning operation
3. Experiment on threading and Knurling operation
4. Experiment on surface grinding
5. Preparation of hexagonal nut on milling machine
6. Cutting a slot on shaper machine
7. Experiment on drilling machine
8. Force measurement using Lathe tool Dynamometer.

PART-B
MACHINE DYNAMICS LAB

LIST OF EXPERIMENTS:

1. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils.
2. Determination of steady state amplitude of forced vibratory system.
3. Static balancing using steel balls.
4. Determination of the magnitude and orientation of the balancing mass in dynamic balancing.
5. Determination of the magnitude of gyroscopic couple, angular velocity of precession, and representation of vectors.
6. An experiment on pin-on-disc apparatus.

III B.TECH II SEMISTER

III B.Tech - II SEMESTER COURSE STRUCTURE

S.No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Metrology & Instrumentation	PC	4	-	-	40	60	100	3
2	Design of Mechanical Components	PC	3	1	-	40	60	100	3
3	Heat Transfer	PC	3	1	-	40	60	100	3
4	Automobile Engineering	ES	4	-	-	40	60	100	3
5	**ELECTIVE-I**	PE							
	Gas Turbines and Jet Propulsion		3	1	-	40	60	100	3
	Fracture Mechanics								
	Jigs, Fixtures& Press Tool Design								
	Industrial Engineering and Cost Estimation								
6	Open Elective-II (See the List of Open Electives)	OE	4	-	-	40	60	100	3
7	Heat Transfer Lab	PC	-	-	3	25	50	75	2
8	Metrology & Instrumentation Lab	PC	-	-	3	25	50	75	2
9	Reasoning (Mandatory Non Credit Course)	MDC	3	-	-	-	-	-	-
	TOTAL		**24**	**3**	**6**	**290**	**460**	**750**	**22**

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
METROLOGY AND INSTRUMENTATION							

COURSE OUTCOMES:

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

CO1: Analyze the design tolerances and fits for selected product quality.
CO2: Measure the length, angle and tapers by using instruments.
CO3: Analyze the concepts of limit gauges and optical measurements.
CO4: Evaluate the basic principles of instrumentation
CO5: Measure of mechanical parameters using different transducers.
CO6: Measure the temperature, stress and strain using various instruments**.**

UNIT – I:

SYSTEMS OF LIMITS AND FITS: Introduction, nominal size, tolerance, limits, deviations, fits -Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, and selective assembly. International standard system of tolerances, selection of limits and tolerances for correct functioning.

UNIT – II:

LINEAR MEASUREMENT: Length standards, end standards, slip gauges- calibration of the slip gauges, dial indicators, micrometers.

MEASUREMENT OF ANGLES AND TAPERS: Different methods – bevel protractor, angle slip gauges- spirit levels- sine bar, rollers and spheres used to measure angles and tapers.

UNIT – III:

LIMIT GAUGES: Taylor's principles-design of GO and NO GO gauges; plug, ring, snap, gap, taper, profile and position gauges**.**

OPTICAL MEASURING INSTRUMENTS: Tools maker's microscope and uses, autocollimators, optical projector, optical flats and their uses.

UNIT – IV:

BASIC PRINCIPLES OF INSTRUMENTATION: Units and standards – Static measurements – Scale and pointer type instruments – Definition of range, sensitivity, hysteresis, accuracy, precision, reliability, repeatability, linearity, drift, Static and dynamic response, reproducibility, calibration procedure, errors in measuring instruments, source of errors.

UNIT – V:

TRANSDUCERS &MEASUREMENTS OF MECHANICAL PARAMETERS: Transducers – Actuating mechanisms – Classification of transducers. Proving ring, Bourdon tube, Mass sensing elements, piezoelectric transducers, Anemometers.

UNIT – VI:

MEASUREMENT OF TEMPERATURE: Classification, ranges, various principles of measurement, expansion, electrical resistance, thermistor, thermocouple, pyrometers

STRAIN MEASUREMENTS: Various types of strain measurements, electrical strain gauge, gauge factor, usage for measuring torque, strain gauge rosettes.

TEXT BOOKS:

1. Engineering Metrology, Mahajan, DhanpatRai Publishers.
2. Measurement Systems Applications & design by D.S Kumar, Khanna Publishers.

REFERENCE BOOKS:

1. Engineering Metrology, R.K.Jain, Khanna Publishers.
2. Engineering Metrology by I.C.Gupta, DhanpatRai Publishers.
3. Mechanical and Industrial Measurements, R.K. Jain, Khanna Publisher

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
DESIGN OF MECHANICAL COMPONENTS (Design Data Hand Book Allowed)							

COURSE OUTCOMES:

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

CO1: **Apply** the design procedure to engineering problems, including the consideration of technical and manufacturing constrains of bearings.

CO2: **Design** of I.C engine components of Connecting Rod, Cranks, Crank shafts.

CO3: **Design** and proportions of piston, Cylinder. Cylinder liners.

CO4: **Determine** the expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section

CO5: **Determine** the capacities of power transmission of Belt, Rope and Chain Drives**.**

CO6: **Design** of Power Screws and Gears for Static and Dynamic loads.

UNIT – I:

DESIGN OF BEARINGS: Types of Journal bearings, Lubrication, Bearing Modulus, Full and partial bearings, Clearance ratio, Heat dissipation of bearings, bearing materials, Journal bearing design, Ball and roller bearings, Static loading of ball & roller bearings, Bearing life.

UNIT – II:

DESIGN OF I.C ENGINE COMPONENTS: Connecting Rod, Thrust in connecting rod, Stress due to whipping action on connecting rod ends, Cranks and Crank shafts, strength and proportions of over hung and centre cranks, Crank pins, Crank shafts.

UNIT – III:

Pistons, Forces acting on piston, Construction, Design and proportions of piston, Cylinder. Cylinder liners.

UNIT – IV:

DESIGN OF CURVED BEAMS: introduction, stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section, C – clamps. Design of crane hook.

UNIT – V:

POWER TRANSMISSION SYSTEMS: Transmission of power by Belt and Rope drives, Transmission Efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives, Materials, Chain drives.

UNIT – VI:

DESIGN OF POWER SCREWS: Square, ACME, Buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures. Spur& Helical gear drives: Spur gears- Helical gears – Load concentration factor – Dynamic load factor. Surface Compressive strength – Bending strength – Estimation of Centre distance, module and face width.

REFERENCES:

1. Machine Design, R.N. Norton, Pearson Publishers.
2. Design Data hand book. Mahadevan, CBS Publishers.
3. Mechanical Engineering Design, JE Shingly, Tata McGraw Hill Publishers.

TEXT BOOKS:

1. Machine Design, V.B. Bandari, Tata McGraw Hill Publishers.
2. Machine Design, Pandya & Shaw, Charotar publishers.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
HEAT TRANSFER (Heat transfer data book allowed)							

COURSE OUTCOMES:

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

CO1: **After** successful completion of this course, the students will be able to:
CO2: **Apply** basic principles of fluid mechanics, thermodynamics, heat transfer for designing heat and mass transfer systems.
CO3: **Analyze** heat, mass and momentum transport systems to show predictive correlation.
CO4: **Evaluate** the hydrodynamic and thermal boundary layer for convective heat transfer.
CO5: **Evaluate** the Heat Expanding devices using LMTD and NTU methods.
CO6: **Analyze** the basics of boiling, condensation using empirical correlations.
CO7: **Examine** the heat exchange between grey bodies, radiation shields, and electrical analogy for radiation networks.

UNIT – I:

INTRODUCTION: Modes and mechanisms of heat transfer, Basic laws of heat transfer, and applications of heat transfer. Conduction Heat Transfer, Fourier equation, general heat conduction equation in Cartesian, Cylindrical and Spherical coordinates simplification and forms of the field equation. Steady, unsteady, and periodic heat transfer, initial and boundary conditions.

ONE DIMENSIONAL STEADY STATE CONDUCTIONHEAT TRANSFER: Homogeneous slabs, hollow cylinders, and spheres, Composite systems, overall heat transfer coefficient, Electrical analogy, and Critical radius of insulation.

UNIT – II:

ONE DIMENSIONAL STEADY STATE CONDUCTION HEAT TRANSFER: Variable Thermal conductivity, systems with heat sources or Heat generation. Extended surface (fins) Heat Transfer, Long Fin, Fin with insulated tip and Short Fin

ONE DIMENSIONAL TRANSIENT CONDUCTION HEAT TRANSFER: Systems with negligible internal resistance, significance of Biot and Fourier Numbers, Infinite bodies, Chart solutions of transient conduction systems, Concept of Semi-infinite body.

UNIT – III:

CONVECTIVE HEAT TRANSFER: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow. Dimensional analysis as a tool for experimental investigation, Buckingham Π Theorem and method, application for developing semi-empirical non-dimensional correlation for convection heat, significance of non-dimensional numbers.

FORCED CONVECTION: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer, Flat plates and Cylinders.

UNIT – IV:

INTERNAL FLOWS: Concepts about Hydrodynamic and Thermal Entry Lengths(TEL), Division of internal flow based on TEL, Use of empirical relations for Horizontal Pipe Flow and annulus flow.

FREE CONVECTION: Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes. **HEAT EXCHANGERS:** Classification of heat exchangers, overall heat transfer Coefficient and fouling factor, LMTD and NTU methods, Problems on LMTD and NTU methods.

UNIT – V:

HEAT TRANSFER WITH PHASE CHANGE: Boiling, Pool boiling, Regimes, Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

CONDENSATION: Film wise and drop wise condensation, Nusselt's Theory of Condensation on a vertical plate, Film condensation on vertical and horizontal cylinders using empirical correlations.

UNIT - VI:

RADIATION HEAT TRANSFER : Emission characteristics and laws of black-body radiation, Irradiation, total and monochromatic quantities, laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann, heat exchange between two black bodies, concepts of shape factor, Emissivity, heat exchange between grey bodies, radiation shields, electrical analogy for radiation networks.

TEXT BOOKS:

1. Fundamentals of Engineering Heat and Mass Transfer, R.C.Sachdeva, New Age International.
2. Heat Transfer, P.K.Nag, Tata McGraw Hill.

REFERENCE BOOKS:

1. Essential Heat Transfer, Christopher A Long, Pearson Publishers
2. Heat Transfer, J.P.Holman, Tata McGraw Hill
3. Principles of Heat Transfer, Frank Kreith, RM Manglik& MS Bohn, Cengage learning publishers.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
AUTOMOBILE ENGINEERING							

COURSE OUTCOMES:

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

CO1: Identify chassis models for different automobile applications
CO2: Analyze the concept of Ignition and Fuel supply system.
CO3: Estimate suitable conventional and automatic transmission system.
CO4: Analyze the steering, braking and suspension systems.
CO5: Identify the usage of Electrical vehicles / Hybrid vehicles and power plants.
CO6: Distinguish the formation of pollution and its control methods**.**

UNIT – I:

INTRODUCTION TO VEHICLE STRUCTURE AND ENGINE COMPONENTS: Vehicle construction, Chassis and body, Specifications, Engine Types-Construction, Location of engine, Cylinder arrangement , Construction details, Cylinder block, Cylinder head, Cylinder liners. Lubrication system, Types, Oil pumps, Filters, Cooling system, Types, Water pumps, Radiators, Thermostats, Anti-freezing compounds.

UNIT – II:

IGNITION, FUEL SUPPLY: Ignition system, Coil and Magneto, Spark plug, Distributor, Electronic ignition system, Fuel system, Carburettor, Fuel pumps, Fuel injection systems, Mono point and Multi point, Unit injector, Nozzle types, Electronic Fuel Injection system, MPFI, DTSI.

UNIT – III:

TRANSMISSION SYSTEM:

CLUTCHES- Function, Types, Single plate, multiple plate, Fluid coupling,

GEARBOX - Sliding, Constant, Synchromesh, Overdrive, Torque converter, automatic transmission system – Epicylic.

PROPELLER SHAFT - Hotchkiss drive, Final drive, Rear axle assembly

DIFFERENTIAL - Need, Construction.

UNIT – IV:

STEERING, SUSPENSION AND BRAKING SYSTEM:

STEERING - Principle of steering, Steering Geometry and wheel alignment, steering linkages, Steering gearboxes, Power steering

SUSPENSION - front axle Suspension system, Independent and Solid axle. Coil, leaf spring and air suspensions, torsion bar, shock absorbers

BRAKING SYSTEM needs Classification, Drum and Disc, Mechanical, Hydraulic and pneumatic, vacuum assist Retarders, Anti-lock Braking System.

UNIT – V:

AUTOMOBILE ELECTRICAL SYSTEMS, SAFETY AND ADVANCES: ELECTRICAL SYSTEMS- Battery, General electrical circuits, cut out relay, Dash board instrumentation, Passenger comfort, SAFETY- Seat belts, air bags, HVAC Systems, Automotive Electronics, Electronic Control Unit, Traction Control System ADVANCES: Hybrid Electric Vehicles.

UNIT – VI:

ENGINE EMISSION CONTROL: Introduction, types of pollutants, mechanism of formation, concentration measurement, methods of controlling, engine modification, exhaust gas treatment thermal and catalytic converters-use of alternative fuels for emission control – National and International pollution standards

ENGINE SERVICE: Introduction, service details of engine cylinder head, valves and valve mechanism, piston-connecting rod assembly, cylinder block, crank shaft and main bearings, engine reassembly-precautions.

LIGHT WEIGHT MATERIALS: Carbon fibre composites, glass fibre composites, aluminum and Al matrix composites, magnesium alloys, aluminum alloys, advanced high strength steel, applications.

TEXT BOOKS:

1. Automotive Mechanics, Vol. 1 & Vol. 2, Kirpal Sing, standard publishers.
2. Automobile Engineering- P.S Gill, S.K. Kataria & Sons, New Delhi.

REFERENCE BOOKS:

1. David A. Corolla, (2009), Automotive Engineering: Powertrain, Chassis System and
2. Automotive Engines Theory and Servicing, James D. Haldermanand Chase D. Mitchell Jr., Pearson education inc.
3. Automobile Engineering, William Crouse, Tata McGraw Hill Distributors.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ELECTIVE-I GAS TURBINES AND JET PROPULSIONS							

COURSE OUTCOMES:

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

- **CO1:** **Distinguish** different kinds of jet engines and rocket engines.
- **CO2:** **Analyze** the working of different components of jet engines.
- **CO3:** **Identify** the functions and flow characteristics of nozzle.
- **CO4:** **Identify** the functions and flow characteristics of diffusers.
- **CO5:** **Categorize** the components of Ramjet and it uses.
- **CO6:** **Discover** the concepts of rocket propulsion, propellants.

UNIT – I:

FUNDAMENTALS OF GAS TURBINE ENGINES: Introduction and Basic review of thermodynamic concepts and Gas turbine cycle with regeneration, reheating and intercooling, various methods to improve efficiency and work output of gas turbine, Fundamentals of gas turbine engine use as aircraft power plant, turbojet, turbofan and turboprop engines.

UNIT – II:

GAS TURBINE COMBUSTION CHAMBER/BURNER: Introduction and types of burners, Can burner, Annular burner, Cannular burner, Relative advantages and disadvantages of different types of burners, zones of combustion chamber, requirements of combustion chamber, design criteria of combustion chamber, pressure losses, combustion intensity and combustion efficiency, flame stabilization and flame holder, Design parameters of combustion chamber, Materials for combustion chamber.

UNIT – III:

NOZZLE THEORY: Basic review of thermodynamics and one dimensional isentropic flow, Area –Mach relation and types of nozzle, Exhaust velocity of nozzle, Mass flow rate through nozzle and choking of nozzle, Area ratio of nozzle, Effect of back pressure, Optimum expansion, under expansion and over expansion nozzle, Various nozzle configurations, Different Types of Nozzle, Actual mass flow rate through nozzle and equilibrium conditions.

UNIT – IV:

DIFFUSERS / INLETS: Introduction to inlets, subsonic and supersonic inlets Inlet Types internal compression inlet, external compression inlet and mixed compression inlet, subsonic inlets design variables, inlet total pressure ratio, inlet sizing and inlet flow distortion, Nacelle and interference drag. Boundary layer separation and features of external flow near a subsonic inlet, internal flows and stalling in subsonic inlets, relation between minimum area ratio and internal deceleration ratio, Supersonic Inlets , design construction and working, numericals.

UNIT – V:

RAMJET PROPULSION: Introduction and operating principle, Advantages, disadvantages, limitations and comparison with jet engines, Subcritical, critical and super critical operation, Ramjet performance, Simple design calculation of ramjet engine, Introduction to scramjet and preliminary concepts in supersonic combustion.

UNIT – VI:

ROCKET PROPULSION: Introduction to rocket propulsion and operating principle, Classification of rocket propulsion system, Introduction to solid propellant rockets and liquid propellant rockets.

TEXT BOOKS:

1. Gas Turbines, V.Ganesan, Tata McGraw Hill Publishers.
2. Mechanics and Dynamics of Propulsion, Hill and Peterson, John Wiley & Sons.

REFERENCES:

1. Gas Turbine Theory, Cohen and Rogers, Pearson Publishers.
2. Gas Turbines & Propulsive Systems, Khajuria & Dubey, Dhanpat Rai & Sons.
3. Rocket Propulsion, Ramamurthi, MacMilan Publishers.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ELECTIVE-I FRACTURE MECHANICS							

COURSE OUTCOMES:

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

CO1: **Analyze** the failure of the products manufactured through various processes and suggests remedial methods.

CO2: **Identify** the energy release rate (G), and fracture energy for the materials.

CO3: **Analyze** the linear elastic fracture mechanism theories and apply them for fatigue studies.

CO4: **Analyze** elastic plastic fracture mechanism theories and apply them for fatigue studies

CO5: **Identify** the reasons for failures in different production processes, Forging, Casting and welding

CO6: **Identify** Fatigue limits Total life and damage tolerant approaches to life prediction.

UNIT – I:

INTRODUCTION: Prediction of mechanical failure. Macroscopic failure modes brittle and ductile behavior. Fracture in brittle and ductile materials-characteristics of fracture surfaces; inter- granular and intra-granular failure, cleavage and micro-ductility, growth of fatigue cracks, the ductile/brittle fracture transition temperature for notched and un-notched components. Fracture at elevated temperature.

UNIT – II:

GRIFFITH'S ANALYSIS: Concept of energy release rate (G), and fracture energy, R(Material Resistance to Crack Extension).Modification for ductile materials, loading conditions. Concept of Rcurves.

UNIT – III:

LINEAR ELASTIC FRACTURE MECHANICS (LEFM): Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor, crack tip plasticity, effect of thickness on fracture toughness.

UNIT – IV:

ELASTIC-PLASTIC FRACTURE MECHANICS (**EPFM):** The definition of alternative failure prediction parameters, Crack Tip Opening Displacement, and the J integral. Measurement of parameters and examples of use.

UNIT – V:

Failure Of Forging, Casting And Weldments Causes of Failure in Forging like material characteristics, Deficiencies in design, Improper Processing / Fabrication or Deterioration resulting from service conditions, Failure of Iron and Steel Castings, effect of Surface Discontinuities, Internal Discontinuities, Microstructure, Improper Composition, Improper Heat Treatment, Stress Concentration and Service Conditions. Failure of Weldments, Reasons for Failure procedure for Weld Failure Analysis.

UNIT – VI:

FATIGUE: Definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, mean stress R ratio, strain and load control. S-N curves. Goodman's rule and Miners ruleMicro-mechanisms of fatigue damage, fatigue limits and initiation and propagation control, leading to a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction

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TEXT BOOKS:

1. Dislocations and Mechanical Behavior of Materials, M. N. Shetty, PHI Publications
2. Fracture Mechanics Fundamentals and Applications, T.L. Anderson, CRC press.

REFERENCES:

1. Fracture of Brittle Solids, B. Lawn, Cambridge Solid State Science Series
2. Fundamentals of Fracture Mechanics, J.F. Knott, Butterworths Publications
3. Material Science and Metallurgy, Dr V.D. Kodgire and S.V.Kogire, Everest Publishing house.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3

ELECTIVE-I
JIGS, FIXTURES & PRESS TOOL DESIGN

COURSE OUTCOMES:

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

CO1: **Analyze** the locating and clamping principles.
CO2: **Design** of jigs for given components
CO3: **Design** of fixtures for given components.
CO4: **Analyze** the press working terminologies and elements of dies and strip layout.
CO5: **Design** the progressive and compound dies for Blanking and piercing operations.
CO6: **Categorize** different forming techniques.

UNIT – I:

LOCATING AND CLAMPING PRINCIPLES: Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – 3-2-1 principle - Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT – II:

DESIGN OF JIGS: Principles of jigs and fixtures - Locating elements - Drill bushes - Different types of jigs - Plate, latch, channel, post, angle plate, turn over, and pot jigs - Automatic drill jigs, Design and development of jigs for given components.

UNIT – III:

DESIGN OF FIXTURES: Design principles of fixtures - Design of fixtures for milling, boring. Design of fixture for assembly, inspection and welding. Design and development of fixtures for given components.

UNIT – IV:

PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT: Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block-die shoe. Bolster plate-punch plate punch holder-guide pins and bushes – strippers –knockouts-stops –pilots-Selection of standard die sets strip layout-strip layout calculations

UNIT – V:

DESIGN AND DEVELOPMENT OF DIES: Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion dies.

UNIT – VI:

FORMING TECHINIQUES: Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, recent trends in tool design, computer Aids for sheet metal forming Analysis, basic introduction, tooling for numerically controlled machines- setup reduction for work holding.

TEXT BOOKS:

1. Production engineering, P.C Sharma. S.Chand Publications.
2. Tool Design, Donaldson, Lecain and Goold, III rd Edition Tata McGraw Hill, 2000.

REFERENCE BOOKS:

1. Jigs and Fixtures – Non-standard clamping device, Hiram E. Grant, Tata McGraw Hill, New Delhi, 1971.
2. Press tool design and construction, 1st edition, Prakash H. Joshi, Wheeler Publishing, New Delhi, 2000.
3. An Introduction to Jig and tool design, 3rd edition, Kempster, M. H. A., ELBS, 1987.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ELECTIVE –I INDUSTRIAL ENGINEERING AND COST ESTIMATION.							

COURSE OUTCOMES:

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

CO1: Discuss fundamental knowledge and skill sets required in the Industrial Management and Industrial engineering.

CO2: Analyze the concepts of human resource management, job evaluation and merit rating.

CO3: Analyze the concepts of wages and intensive systems.

CO4: Solve various problems related to estimating and costing of a product.

CO5: Categorize the techniques of estimating weights and volumes of materials.

CO6: Distinguish the welding, forging and foundry cost estimation.

UNIT – I:

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management. Reliability: introduction, importance & definition, bath tub curve, system reliability.

UNIT – II:

RESOURCE MANAGEMENT: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, methods of merit rating, advantaged and disadvantages of merit rating.

UNIT – III:

WAGE & INTENSIVE SYSTEMS:

Wages – definition, types – wage differentials – reasons, methods of wage payments, types of incentives, standard wage plans – Halsey, Weir, Emerson's, Rowans Gantt's task and Bonus systems, - Taylor's piece rate systems, Merric's piece rate system – Numerical problems on the above plans, incentives to the supervisor and executives.

UNIT – IV:

FUNDAMENTALS OF ESTIMATION AND COSTING: Objectives and functions of estimation; Principal Constituents of the estimation; estimation procedure: Labour, materials, overheads, miscellaneous expenses; Objectives of cost accounting – elements of cost viz., material, labour and expenses – Calculate the selling price of a product; Depreciation-causes-calculation of depreciation charges by a few important methods (Straight line method, Sinking fund method, Reducing balance method, Sum of Years digits method).

UNIT – V:

ESTIMATION OF WEIGHTS AND VOLUMES OF MATERIALS: Principles of dividing the component drawing into simple and smaller geometrical configurations; Calculation of volumes and the weight of the material; Estimating the cost ; Exercises in the calculation of weight of material and cost.

UNIT – VI:

ESTIMATION OF WELDING, FORGING AND FOUNDRY COST: Estimate the cost of fabrication by gas welding and arc welding; Estimation of Forging Cost: Estimation of stock weight, net weight, gross weight, losses in forging; Exercises in the estimation of length, net and gross weight and cost of forging for given components. Estimation of foundry cost: Process for finding the foundry cost, cost of metal, cost of metal melting, moulding, core cost, cleaning cost, grinding and tooling cost. Exercises in estimating the foundry cost.

TEXT BOOKS:

1. Industrial engineering by M.I Khan,New Age International,2004.
2. Industrial engineering and estimating and costing by M. Gopalaiah, Radiant publishing house.

REFERENCES:

1. Industrial Engineering and management by O.P Khanna, Khanna publishers.
2. Industrial Engineering & - Estimating & Costing- by M.ZakriaBaig. Radiant publishing house.
3. Industrial Engineering & Management Science. – by T.R.Banga, Khanna publishers.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
OPEN ELECTIVE –II NANO TECHNOLOGY							

COURSE OUTCOMES:

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

CO1: **Analyze** the basics of nano materials and technology.
CO2: **Evaluate** the synthesis of nano materials.
CO3: **Develop** an idea for preparation of nano size materials.
CO4: **Analyse** the basics of nano tubes etc.
CO5: **Discuss** the knowledge on tools used in nano technology.
CO6: **Analyze** the fundamentals on fabrication at nano level.

UNIT – I:

INTRODUCTION: Evolution of science and technology, Introduction to Nanotechnology, Nanotechnology-Definition, Difference between Nanoscience and Nanotechnology, Feynman predictions on Nanotechnology, Moore's law, Bottom up and top down approaches, challenges in Nanotechnology .

UNIT – II:

NANO MATERIALS, SYNTHESIS: History of materials, Nanomaterial Definition, Classification of Nanostructured materials, causes of interest in nanomaterial, some present and future applications of nanomaterial.

UNIT – III:

PROCESSING OF NANO MATERIALS: Processes for producing ultrafine powders mechanical grinding, wet chemical synthesis of nanomaterial. Gas phase synthesis of Nanomaterial, gas condensation processes, chemical vapour condensation, laser ablation.

UNIT – IV:

SPECIAL NANOMATERIAL: Carbon nanotubes, Nanocomposites, nano fluids-An overview over preparation, properties, applications.

UNIT – V:

CHARACTERIZATION AND TOOLS: Electron Microscopy Techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Tunnelling Microscopy, Atomic Force Microscopy, Scanning Probe Microscopy- X ray methods -Fluorescence

UNIT – VI:

NANOFABRICATION: Introduction - micro, nanofabrication: Optical lithography, Electron beam lithography, Atomic lithography, Molecular beam epitaxy, MEMS, NEMS -An introduction. Nanotechnology applications in Mechanical Engineering: Nano mechanics, Nano scale heat transfer, nano-machining, molecular dynamic simulation - An introduction.

TEXT BOOKS:

1. Nano science and nanotechnology by M.S. Ramachandra Rao, Shubrasingh, Wiley publishers
2. Nano structures & Nano materials by Guozhongcao, Imperial college press.2nd Edition

REFERENCE BOOKS:

1. Micro manufacturing and Nano Technology by N.P.Mahalik,.Springer,2006.
2. Nano Technology by Mark Ratner & Danier Ratner, Prentice Hall
3. Nano materials by A S Edelstein& R C Cammarata, Institute of physics publishing, Bristol and Philadelphia.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
OPEN ELECTIVE –II WORK STUDY							

COURSE OUTCOMES:

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

CO1: **Analyze** the fundamental concepts of work systems and work study.
CO2: **Analyze** the movements of workers and materials at work place.
CO3: **Examine** work measurement and method study.
CO4: **Apply** various types of engineering work measurements such as direct time study, predetermined motion time systems (PMTs).
CO5: **Analyze** work sampling and predetermined time standards.
CO6: **Evaluate** the maynard operation sequence technique.

UNIT – I:

Work Study Fundamentals: Productivity and Work Study, Definitions, Scope, and History of Work Study, Tools of productivity, Productivity index, Kinds of productivity Measurements, Causes of low productivity and techniques of their elimination, technical Methods to improve productivity.

UNIT – II:

Movement of workers and material at workplace, string diagram, flow process charts: worker material and equipment type, multiple activity chart: Man, Machine, Machine-Machine chart, Travel charts for workplace. Principles of motion economy, Classification of movements, Two handed process chart, SIMO charts, Micro Motion study, Therbligs, Use of Therbligs in examining common industrial tasks.

UNIT – III:

WORK MEASUREMENT: Objectives, basic procedure, Techniques of work measurement **METHOD STUDY:** Definition, objectives and basic procedure. Record, Examine, Develop, Evaluate, Define, Install and maintain methods, Process chart symbols, Outline and flow process charts, Flow diagrams, Critically Examine Techniques.

UNIT – IV:

TIME STUDY: Equipment and forms, selection of a job, steps in time study, breaking the job into elements, timing the elements; Rating in time study – standard rating and standard performance, factors affecting rate of working, standard time determination, use of time standards, allowances.

UNIT – V:

WORK SAMPLING: Need, procedure for work sampling, underlying statistical distribution, determining time standards by work sampling.

PREDETERMINED TIME STANDARDS (PTS) – definition, methods time measurement (MTM), standard data from PTS, applications of PTS in different industrial situations

UNIT – VI:

MAYNARD OPERATION SEQUENCE TECHNIQUE: Introduction, Methodology, Basic MOST, Mini MOST, Maxi MOST, Applications to industrial cases

TEXT BOOKS:

1. Work Study, OP.Khanna, DhanpatRai Publications.
2. Industrial Engineering Handbook, Maynard, Tata McGraw Hill.

REFERENCES:

1. Time and Motion Study Design, Barnes, R.M., John Wiley Publications.
2. Work Study & Ergonomics, L.C. Jhamb, Everest Publications.
3. Introduction to Work Study, George Kanawaty, International Labor Office.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
HEAT TRANSFER LAB							

COURSE OUTCOMES:

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

CO1: **Evaluate** the amount of heat exchange for plane, cylindrical & spherical geometries

CO2: **Determine** the heat transfer coefficient in natural and forced convection.

CO3: **Distinguish** the performance of extended surfaces and heat exchangers.

LIST OF EXPERIMENTS:

1. Determination of overall heat transfer co-efficient of a composite slab.
2. Determination of heat transfer rate through a lagged pipe.
3. Determination of heat transfer rate through a concentric sphere.
4. Determination of thermal conductivity of a metal rod.
5. Determination of efficiency of a pin-fin.
6. Determination of heat transfer coefficient in forced convection.
7. Determination of heat transfer coefficient in natural convection.
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of emissivity of a given surface.
10. Determination of Stefan Boltzmann constant.
11. Determination of heat transfer rate in drop and film wise condensation.
12. Determination of critical heat flux.
13. Study of two-phase flow.

III B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
METROLOGY & INSTRUMENTATION LAB							

COURSE OUTCOMES:

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

CO1: Examine different instruments that are available for linear, angular and roughness measurements

CO2: Select proper measuring instrument and know the requirement of calibration, errors in measurement etc.

CO3: Examine pressure gauge, transducer, LVD, strain gauge, thermocouple, capacitive transducer, photo and magnetic speed pickups, Calibration of resistance temperature detector.

METROLOGY LAB:

1. Measurement of lengths, heights, diameters by Vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth Vernier caliper for tooth thickness inspection and flange micro meter for checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe, drilling & milling machines.
5. Angle and taper measurements with bevel protractor, Sine bars, rollers and balls.
6. Use of spirit level in finding the straightness of a bed and flatness of a surface.
7. Thread inspection with two wires/ three wire method & tool maker's microscope.
8. Surface roughness measurement with roughness measuring instrument.

INSTRUMENTATION LAB:

1. Calibration of pressure gauge.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge.
5. Calibration of thermocouple.
6. Calibration of capacitive transducer.
7. Study and calibration of photo and magnetic speed pickups.
8. Calibration of resistance temperature detector.
9. Study and calibration of a Rota meter.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of McLeod gauge for low-pressure

IV B.TECH I SEMISTER

IV B.Tech - I SEMESTER COURSE STRUCTURE

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Finite Element Methods	PC	3	1	-	40	60	100	3
2	CAD/CAM	PC	4	-	-	40	60	100	3
3	Advanced Manufacturing Processes	PC	4	-	-	40	60	100	3
4	Open Elective-III (See the List of Open Electives)	OE	4	-	-	40	60	100	3
5	**ELECTIVE-II**	PE							
	Power Plant Engineering		4	-	-	40	60	100	3
	Tribology and Bearing Design								
	Advanced Tool Design								
	Facility Layout and Material Handling								
6	**ELECTIVE-III**	PE	3	1	-	40	60	100	3
	Computational Fluid Dynamics								
	Rapid Prototyping								
	Advanced Mechanics of Solids								
	Production planning & Control								
7	CAD/CAM Lab	PC	-	-	3	25	50	75	2
8	Mini Project-II	PRC	-	-	-	25	50	75	2
9	NSS (Mandatory Non Credit Course)	MDC	-	-	2	-	-	-	-
	TOTAL		**22**	**2**	**5**	**290**	**460**	**750**	**22**

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
FINITE ELEMENT METHODS							

COURSE OUTCOMES:

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

CO1: **Derive** displacement, stress, strain relations and apply vibrational and weighted residual methods to solve differential equations.

CO2: **Determine** the elongation, stresses and strains in one dimensional bar problems.

CO3: **Determine** the displacement in Truss and deflections in beams

CO4: **Compute** stress and strains in two dimensional problems using constant strain triangle and also parametric elements.

CO5: **Evaluate** the rate of heat transfer and temperature distribution in thin plates and fin.

CO6: **Determine** natural frequencies of free vibration problems.

UNIT – I:

INTRODUCTION: Stress and equilibrium, strain, displacement relations, stress, strain relations, plane stress and plane strain conditions, vibrational and weighted residual methods

FINITE ELEMENT METHOD: Discretization, Types of elements, band width, node numbering, and interpolation functions, local and global coordinates, convergence requirements, Types of boundary conditions, Steps in Finite Element Method, Applications of Finite Element Method.

UNIT – II:

ONE DIMENSIONAL BAR PROBLEMS: 1-D bar element, shape functions, Stiffness matrix and load vector, assembly of Matrices, Treatment of boundary conditions- One dimensional quadratic element.

UNIT – III:

ANALYSIS OF TRUSS: Truss element, element Stiffness matrices, simple problems on truss **ANALYSIS OF BEAMS:** Beam Element, Shape functions and Element stiffness matrix, load vector for concentrated and Uniformly Distributed Load, simple problems on beams.

UNIT – IV:

TWO DIMENSIONAL PROBLEMS: Finite element modelling of two dimensional Problems - constant strain triangle Element - treatment of boundary conditions 2-D four nodded iso-parametric element, numerical integration , Gaussian Quadrature Approach.

UNIT – V:

STEADY STATE HEAT TRANSFER ANALYSIS: 1- D Thermal analysis of thin plane walls, analysis of a fin.

UNIT – VI:

DYNAMIC ANALYSIS: Free Vibrations, Longitudinal Vibrations and Transverse Vibrations, Eigen Values and Eigen Vectors, Natural Frequencies for bar and beam problems.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering, Chandraputla, Ashok and Belegundu, Prentice – Hall.
2. Finite Element Analysis, Sk.Md. Jalaluddin, Anuradha Publications.

REFERENCE BOOKS:

1. An introduction to Finite Element Method, JN Reddy, McGrawHill.
2. A first course in finite element method, Daryl L Logan, Cengage Learning.
3. Finite Element Analysis -Theory and Programming, C. S. Krishnamoorthy, Tata McGraw Hill.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
CAD/CAM							

COURSE OUTCOMES:

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

CO1: Analyze the fundamental concepts of the Product cycle and Design process.

CO2: **Build** the mathematical basis in the technique of representation of geometric entities and the technique of transformation of geometric entities using transformation matrix.

CO3: Develop the 2D and 3D geometries using Modeling packages.

CO4: **Evaluate** the NC, CNC and DNC machines and part programming methods.

CO5: Analyze the use of GT for the product development and also the use of CAPP for the product development.

CO6: **Identify** the various elements and their activities in the Computer Integrated Manufacturing Systems

UNIT – I:

INTRODUCTION: Fundamentals of Product cycle- Design process, Computers in design applications, benefits of CAD, Computer configuration for CAD applications, graphics terminal, memory types, input devices, display devices, hard copy devices, and storage devices.

COMPUTER GRAPHICS: Database structure for graphics modelling, 2D and 3D transformations, mathematics of projections, clipping

UNIT – II:

GEOMETRIC MODELING: 3D wire frame modelling, wire frame entities, concept of parametric and non-parametric representation of curves, curve fitting techniques, definitions of cubic spline and Bezier, B-spline.

SURFACE MODELING: Algebraic and geometric form, cylindrical surface, ruled surface, surface of revolution, spherical surface, Composite surface, Bezier surface, B-spline surface.

SOLID MODELING: Sweep representation, constructive solid geometry, boundary representations.

UNIT – III:

CAD SOFTWARE: (Drafting and Modelling)**:** Basic geometric commands, layers, display control commands, editing, dimensioning, sweep representation, solid modelling.

UNIT – IV:

CNC MACHINING AND PART PROGRAMMING: Numerical Control (NC) machine tools, NC Tooling and Automatic Tool Changers – CNC types, constructional details, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

UNIT – V:

CELLULAR MANUFACTURING: Group Technology(GT), Part Families, Parts Classification and coding, Simple Problems in Opitz Part Coding system, Production flow Analysis, Cellular Manufacturing, Composite part concept, Machine cell design and layout, Quantitative analysis in Cellular Manufacturing, Rank Order, Clustering Method.

UNIT - VI:

COMPUTER INTEGRATED MANUFACTURING: Types of manufacturing systems, computer aided process planning (CAPP) and types

COMPUTER AIDED QUALITY CONTROL: Terminology used in quality control, use of computers in Quality control. Inspection methods contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

TEXT BOOKS:

1. CAD / CAM / CAE, E.Zimmers & M.Groover, Pearson Education.
2. Automation, Production systems & Computer integrated Manufacturing, Groover,P.E.

REFERENCES:

1. CAD / CAM Theory and Practice, Ibrahim Zeid, TMH.
2. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson.
3. Computer Numerical Control Concepts and programming, Warren S Seames, Thomson.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ADVANCED MANUFACTURING PROCESS							

COURSE OUTCOMES:

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

CO1: **Categorize** the advanced casting methods.
CO2: **Analyze** the principles and applications of electron beam, ion beam and laser hybrid welding processes.
CO3: **Design** for forming and forming of thin sections.
CO4: **Analyze** abrasive and water jet machining.
CO5: **Evaluate** the electrical discharge and electro chemical machining processes.
CO6: **Analyze** Plasma, Electron beam and Laser beam machining process.

UNIT – I:
Stir casting, Magnetic moulding, metal injection moulding, Squeeze casting, Vacuum mould casting, Evaporative pattern casting, Ceramic shell casting.

UNIT – II:
Electron beam welding and Laser beam welding: Principle, application and advantages of EBW and LBW, process parameters. Hybrid welding process-advantages and its applications.

UNIT – III:
Introduction forming processes, advantages ,limitations and applications, Hydro, Magnetic and High velocity forming, design for forming and forming of thin sections.

UNIT – IV:
Abrasive machining, Water jet machining, Abrasive water jet machining, Abrasive flow finishing, mechanism of material removal-problems on MRR, economic considerations, advantages, limitations and applications.

UNIT – V:
MATERIAL REMOVAL PROCESS (Electrical & Chemical): Basic principles of material removal in electro-spark & electro-chemical machining processes, economic considerations, disadvantages and applications, problems on MRR.

UNIT – VI:
MATERIAL REMOVAL PROCESS (Thermal): Plasma Machining, Electron beam machining, Laser beam machining. Basic principles, theory, mechanism of material removal- problems on MRR, economic considerations, disadvantages and applications.

TEXT BOOKS:

1. "Manufacturing Science" A. Ghosh, and A.K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi.
2. Advanced manufacturing process, V. K. Jain, Allied publications.

REFERENCES:

1. Advanced methods of machining, McGeough, J., Chapman & Hall, 2011.
2. Metal Cutting Theory and Practice, Bhattacharya, A., New Central Book Agency, 2011.
3. Wagoner R. H. and Chenot, J-L, Fundamentals of Metal Forming, Wiley, 2009.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
OPEN ELECTIVE -III OPERATIONS RESEARCH							

COURSE OUTCOMES:

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

CO1: **Formulate** the linear programming problems by using graphical solution, simplex method, artificial variables techniques, two–phase method, and big-M method.

CO2: **Formulate** the transportation, assignment problems by using different methods.

CO3: **Evaluate** networking problems with cost analysis, crashing the network, resource scheduling.

CO4: **Categorize** the queuing models and decision models.

CO5: **Analyze** the Inventory models with Buffer stock, ABC & VED Analysis

CO6: **Analyze** the simulation models and phases of simulation**.**

UNIT – I:

Development-definition-characteristics and phases-types of operation research models, applications.

LINEAR PROGRAMMING PROBLEM: Formulation-graphical solution, simplex method artificial variables techniques -two–phase method, big-M method, duality principle.

UNIT – II:

TRANSPORTATION PROBLEM: Formulation, types of initial basic feasible solution using north west corner method (NWCM), least cost method (LCM), Vogel approximation method (VAM) optimal solution, unbalanced transportation problem, degeneracy.

ASSIGNMENT PROBLEM: Formulation, optimal solution variants of assignment problem and travelling salesman problem.

UNIT – III:

NETWORKING MODELS: Earliest Completion time of a project and Critical path, Programme Evaluation Review Technique, Total Slack, Free Slack, Probability of achieving completion date, Cost Analysis, Crashing the network, Resource Scheduling, Advantages, Limitations, Cost Analysis, Distinction between PERT and CPM, LPP Formulation

UNIT – IV:

QUEUING MODELS: Poisson arrivals and Exponential service times, Single channel models and Multi-channel models.

DECISION MODELS: Game theory, two person zero sum game, Graphic solution, Property of dominance, Algebraic solution.

UNIT – V:

INVENTORY: Inventory models, Various Costs and Concepts, EOQ, Deterministic inventory models, Production models, Stochastic Inventory models, Buffer stock, ABC & VED Analysis.

UNIT – VI:

SIMULATION: Definition, types of simulation models, phases of simulation, applications of simulation, inventory and queuing problems, advantages and disadvantages, simulation languages.

TEXT BOOKS:

1. Operations Research, S.D.Sharma, KedarNath Ram Nath Publishers
2. Operations Research, A.M.Natarajan, P.Balasubramani and A. Tamilarasi, Pearson Education.

REFERENCES:

1. Introduction to O.R, Hiller & Libermann Tata McGraw Hill
2. Operations Research, R.Pannerselvam, PHI Publications.
3. Operations Research, Wagner, PHI Publications.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
OPEN ELECTIVE -III ROBOTICS							

COURSE OUTCOMES:

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

CO1: Distinguish between fixed automation and programmable automation.

CO2: Identify various actuators and feedback components of robot.

CO3: Analyze robot applications in manufacturing includes material transfer, material handling and processing.

CO4: Determine the D-H notation joint coordinates and world coordinates of Forward and inverse kinematics.

CO5: Analyze the Lagrange, Euler and Newton, Euler formations of dynamic Problems.

CO6: Plan trajectory, path, slew motion, joint integrated motion, and straight line motion for robot programming.

UNIT – I:

INTRODUCTION: Automation and Robotics, Components of Robot, Mechanical manipulate or control system and end effectors-Types of end effectors, Requirements and challenges of end effectors classification of robots by coordinate system and control system. Control resolution, accuracy, repeatability and work volume of robot.

UNIT – II:

ROBOT ACTUATORS AND FEEDBACK COMPONENTS:

ACTUATORS: Pneumatic, Hydraulic actuators, electric & stepper motors.

FEEDBACK COMPONENTS: position sensors, potentiometers, resolvers, encoders, velocity sensors.

UNIT – III:

ROBOT APPLICATION IN MANUFACTURING: Material Transfer, Material handling, loading and unloading, Processing, spot and continuous arc welding & spray painting, Assembly and Inspection. Future applications of robots.

UNIT – IV:

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation, problems. Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics, problems.

UNIT – V:

Differential transformation and manipulators, Jacobians, problems. Dynamics: Lagrange, Euler and Newton, Euler formations, Problems.

UNIT – VI:

Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint integrated motion, straight line motion, Robot programming.

TEXT BOOKS:

1. Industrial Robotics, Groover M P, Pearson Edu.
2. Robotics and Control, Mittal R K &Nagrath I J,Tata McGraw Hill.

REFERENCE BOOKS:

1. Robotics, Fu K S, McGraw Hill.
2. An Introduction to Robot Technology, P. Coiffet and M. ChaironzeKogam, 1983 London.
3. Robotic Engineering, Richard D. Klafter, Prentice Hall.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ELECTIVE –II POWER PLANT ENGINEERING							

COURSE OUTCOMES

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

CO1: **Examine** basic power generation types and steam cycles.
CO2: **Identify** different boilers and their applications.
CO3: **Categorize** the Combustion equipment and firing methods.
CO4: **Analyze** the Boiling water reactor, Pressurized water reactor, Gas cooled reactor, Pebble bed reactor, and Fast breeder reactor.
CO5: **Categorize** the Hydro-electric power plants and their applications.
CO6: **Analyze** various power generation units in the view of economic, environmental and social requirements.

UNIT – I:

INTRODUCTION TO POWER PLANTS: Power plants, Types, Components and layouts, working principle of Steam, Hydro, Nuclear, Gas Turbine and Diesel power plants, Selection of site, Analysis of steam cycles, Rankine cycle, Reheating and Regenerative cycles.

UNIT – II:

STEAM GENERATORS: Boiler classification, Types of Boilers, Fire tube and Water tube boilers, High pressure and Supercritical boilers, Positive circulation boilers, Fluidized bed boilers, Waste heat recovery Boiler, Feed water heaters, Super heaters, Reheaters, Economiser, Condenser, Cooling tower, Feed water treatment, Air heaters.

UNIT – III:

COMBUSTION AND FIRING METHODS: Coal handling and preparation, Combustion equipment and firing methods, Mechanical stokers, Pulverized coal firing systems, Cyclone furnace, Ash handling systems, Electrostatic Predicator, Fabric filter and Bag house, Forced draft and Induced draft fans-Chimney.

UNIT – IV:

NUCLEAR AND GAS TURBINE POWER PLANTS: Principles of nuclear energy, Energy from nuclear reactions, Energy from fission and fuel Burn up, Boiling water reactor, Pressurized water reactor, Pressurized Heavy Water Reactor, Gas cooled reactor, High temperature gas cooled reactor, Pebble bed reactor, Fast breeder reactor, Liquid metal fast breeder reactor, reactor materials, Radiation shielding, Waste disposal. Gas turbine power plant-Open and closed cycles, Intercooling, Reheating and Regenerating, Combined cycle power plants.

UNIT – V:

HYDRO AND DIESEL POWER PLANTS: Classification of Hydro-electric power plants and their applications, Selection of prime movers, Governing of turbine. Diesel power plant-Subsystems, Starting and stopping, Heat Balance, Supercharging of Diesel engines.

UNIT – VI:

POWER PLANT ECONOMICS AND ENVIRONMENTALCONSIDERATIONS: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, load curves, 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 control.

ENERGY AUDITING: Definition and Objectives of energy management, Energy audit- types and methodology, Need for energy audit, Types of energy audit, Preliminary energy auditing methodology, detailed energy auditing methodology.

TEXT BOOKS:

1. P. K. Nag, (2001), Power Plant Engineering: Steam and Nuclear, Tata McGraw-Hill Publishing Company Ltd., Second Edition.
2. A course in Power Plant Engineering, Arora and Domkundwar, Dhanpatrai& Co.

REFERENCES:

1. Power Plant Technology, M. M. El-Wakil, McGraw-Hill International Editions
2. A Text Book of Power Plant Engineering, R. K. Rajput, Laxmi Publications.
3. Power Plant Engineering, P.C.Sharma, S.K.Kataria Publications.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ELECTIVE -II TRIBOLOGY AND BEARING DESIGN							

COURSE OUTCOMES:

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

CO1: Determination of viscosity by using different viscometers.
CO2: Analyze the hydrostatic squeeze films and its application to journal bearing.
CO3: Determination of Petroffs equation and Reynold's equation by various theories of lubrication.
CO4: Determination of friction in concentric bearings by consideration of journal bearings.
CO5: Analyze the air lubricated bearings including compressibility effect.
CO6: Categorize the types of bearing materials and bearing oil pads.

UNIT – I:

STUDY OF VARIOUS PARAMETERS: Viscosity, flow of fluids, viscosity and its variation-absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used.

UNIT – II:

HYDROSTATIC LUBRICATION: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

UNIT – III:

HYDRODYNAMIC THEORY OF LUBRICATION: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage – Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti -friction bearing.

UNIT – IV:

FRICTION AND POWER LOSSES IN JOURNAL BEARINGS AND ITS APPLICATIONS: Calibration of friction loss friction in concentric bearings, bearing modulus, Somerfield number, heat balance, practical consideration of journal bearing considerations. Study of current concepts of boundary friction and dry friction.

UNIT – V:

AIR LUBRICATED BEARING: Advantages and disadvantages, application of Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect.

UNIT – VI:

TYPES OF BEARING MATERIALS AND BEARING OIL PADS: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings-externally pressurized bearings. General requirements of bearing materials, types of bearing materials.

TEXT BOOK:

1. Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI
2. Tribology in Industry: Sushil Kumar Srivatsava, S. Chand &Co

REFERENCE:

1. Tribology, B.C. Majumdar, Dhanpatrai.
2. Engineering Tribology, Prasntasahoo ,PHI publishers.
3. Fundamentals of Tribology, Ramsey Gohar, homerrahnejat, World scientific publishing Co.pte.Ltd.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ELECTIVE -II ADVANCED TOOL DESIGN							

COURSE OUTCOMES:

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

CO1: **Categorize** the tool design methods, punch and die manufacturing techniques.
CO2: **Develop** design concepts for various cutting tools.
CO3: **Identify** the gages and their nomenclature.
CO4: **Design** of dies, pilots, strippers and pressure pads
CO5: **Design** of splits in mould, split locking, cavity moulds, injection moulds.
CO6: **Analyze** the tool design for NC machine tools.

UNIT – I:

TOOL DESIGN METHODS: Introduction, design procedure, statement of the problem, needs analysis – tentative design solutions, finished design, drafting and design techniques in tooling drawings, punch and die manufacturing techniques

UNIT – II:

DESIGN OF CUTTING TOOLS: Metal cutting process - Selection of tool materials - Design of single point and multipoint cutting tool –lathe, Drills, Milling cutters – Problems on design of single point cutting tool.

UNIT – III:

GAUGES AND GAUGE DESIGN: Introduction, fixed gages, gage tolerances, the selection of material for gages, indicating gauges, automatic gauges and design problems.

UNIT – IV:

DESIGN OF DIES: Die-design fundamentals, blanking and piercing die construction, pilots, strippers and pressure pads, presswork materials, bending dies, forming dies, drawing operations

UNIT – V:

MOULD DESIGN: Splits in mould, split locking, two-cavity and multi-cavity moulds, design details of injection moulds.

UNIT – VI:

TOOL DESIGN FOR NC MACHINE TOOLS: Introduction, need for numerical control (NC), basic explanation of NC, NC systems in use today, Fixture deign for NC machine tools, cutting tools for NC, tool holding methods for NC, tool presetting.

TEXT BOOK:

1. Tool Design, Donaldson Cyrll, George H.LeCain and Goold V.C., TMH, 36th Reprint, 2006.
2. Jigs and Fixtures, Joshi P. H., (2004), 2nd Edition, Tata McGraw-Hill Publishing company Ltd., New Delhi

REFERENCES:

1. Fundamentals of Tool Design, Wilson F.W., ASTME, Prentice Hall, India, 2010.
2. Principles of Machine Tools, G.C. Sen and A. Bhattacharya,New Central Book Agency, Kolkata, 2009.
3. Fundamentals of Tool Design,Jeff Lantrip, David A. Smith and John G. Nee, (2003), 5th Edition, Society of Manufacturing Engineers

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3

ELECTIVE -II
FACILITY LAYOUT AND MATERIAL HANDLING

COURSE OUTCOMES:

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

CO1: **Analyze** the process layout & product layout.
CO2: **Categorize** the computerized layout and analytical methods.
CO3: **Evaluate** the Group Layout, Fixed layout, Quadratic assignment, Branch and bound method.
CO4: **Importance** of material handling systems.
CO5: **Analyze** the methods to minimize cost of material handling and Safety in handling.
CO6: **Analyze** the ergonomics of material handling equipment and lifting principles, lifting assistance, push/pull principles, carrying principles.

UNIT – I:

Introduction-Classification of Lay out, Objectives and principles of plant layout, Advantages and Limitations of different layouts, Layout design procedures. Process layout & product layout: selection, specification, implementation and follow up, comparison of Process layout & product layout. Factors influencing layout

UNIT – II:

Computerized Layout and Analytical Methods: ALDEP, CORELAP, CRAFT: Basic inputs, procedure adopted for using these methods, simple problems, major features, advantages and disadvantages, applications

UNIT – III:

Group Layout, Fixed layout, Quadratic assignment model with examples. Branch and bound method with examples

UNIT – IV:

Material handling systems-Introduction and objectives, Material handling principles. Classification of Material handling equipment-Conveyors, Industrial trucks, Cranes & hoists, Containers and Robots, Relationship of material handling to plant layout

UNIT – V:

Selection and Material handling methods, function oriented systems. Methods to minimize cost of material handling, Maintenance of material handling equipment, Safety in handling. Limitations of Automated Material Handling Systems

UNIT – VI:

Ergonomics of Material handling equipment, Objectives of human engineering. Elements of a Material Handling Ergonomics Program, Analyse management operations, Material flow, Workplace, Analysing manual materials handling tasks, Analyse the job tasks&load, Equipment, Work scheduling, Environment, Recommend, review and implement changes, Review. Material Handling Ergonomics for human-beings- Lifting Principles, Lifting Assistance, Push/Pull Principles, Carrying Principles

TEXT BOOKS:

1. Production and Operations Management by R.Panneerselvam, PHI
2. Plant Layout and Material Handling, by- S. C. Sharma, Jain Brothers

REFERENCES:

1. Introduction to Material handling by Ray, Siddhartha, New age
2. Facility Layout and Location: An Analytical Approach, by Richard L, Francis, Pearson India.
3. Aspects of Material handling, by Dr. KC Arora&Shinde, Lakshmi Publications

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ELECTIVE -III COMPUTATIONAL FLUID DYNAMICS							

COURSE OUTCOMES:

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

- **CO1:** **Determine** the governing equations of fluid dynamics, Continuity, Momentum and energy.
- **CO2:** **Evaluate** the discretization by FDM, FEM and FVM,
- **CO3:** **Develop** the Grid generation for computational fluid dynamics.
- **CO4:** **Analyze** the one-dimensional convection and diffusion.
- **CO5:** **Solve** the flow field equations using different techniques.
- **CO6:** **Analyze** the fluid flow modelling, conservative property, the upwind scheme.

UNIT – I:

INTRODUCTION AND GOVERNING EQUATIONS:

Introduction, Impact and applications of CFD in diverse fields, governing equations of fluid dynamics ,Continuity, Momentum and energy, Generic integral form for governing equations, Initial and Boundary conditions, Governing equations for boundary layers, Classification of partial differential equations, Hyperbolic, Parabolic, Elliptic and Mixed types, Applications and relevance.

UNIT – II:

DISCRETIZATION:

Basic aspects of discretization, Discretization techniques, Finite difference, Finitevolume and Finite Element Method, Comparison of discretization by the three methods, Introduction to Finite differences, Transient one-dimensional and two-dimensional conduction, Explicit Implicit, Crank-Nicolson ADI scheme, Stability criterion. Difference equations, Numerical errors, Grid independence test, Optimum step size.

UNIT – III:

GRID GENERATION:

Grid generation, General transformation of the equations, Form of the governing equations suitable for CFD, Boundary fitted co-ordinate systems, Elliptic grid generation, Adaptive grids, Modern developments in grid generation.

UNIT – IV:

CONVECTION – DIFFUSION:

Steady one-dimensional convection and diffusion, Central difference, upwind, quick, exponential, false diffusion, hybrid and power law schemes. Transient one dimensional heat Conduction equation.

UNIT – V:

CALCULATION OF FLOW FIELD:

Representation of the pressure, Gradient term and continuity equation, staggered grid Momentum equations, Pressure and velocity corrections, Pressure Correction equation, Numerical procedure for SIMPLE algorithm, Boundary conditions for the pressure correction method. Stream function, Discussion of case studies.

UNIT – VI:

INTRODUCTION TO FIRST ORDER WAVE EQUATION: Stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the upwind scheme

TEXT BOOKS:

1. Computational Fluid Dynamics for Engineering/K.A.Hoffman/Vol I –III, Engineering Education System, Austin, Texas.
2. Computational Fluid Dynamics by John D. Anderson /TMH

REFERENCE BOOKS:

1. Computational Fluid Flow and Heat Transfer,K. Muralidhar, T. Sundarajan, (2001), Narosa Publishing House, New Delhi.
2. Numerical Heat Transfer and Fluid Flow, S.V. Patankar, (1999), Hemisphere, New York.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ELECTIVE -III RAPID PROTOTYPING							

COURSE OUTCOMES:

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

CO1: **Discuss** the of Rapid Prototyping technologies with conventional manufacturing process.
CO2: **Analyze** the process of stereo lithography apparatus (SLA) and solid ground curing (SGC).
CO3: **Analyze** the process of laminated object manufacturing (LOM) and fused deposition modelling (FDM)
CO4: **Analyze** the process of selective laser sintering (SLS) and three dimensional printing (3DP)
CO5: **Categorize** the indirect rapid tooling methods and direct rapid tooling methods.
CO6: **Identify** the required process for different applications.

UNIT – I:

INTRODUCTION: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

RAPID PROTOTYPING SYSTEM: practical applications, Basic operations, CAD Model, Translator, supports, slice, merge, prepare, build, cleaning, finishing, benefits of Rapid prototyping, comparison with conventional manufacturing process.

UNIT – II:

LIQUID-BASED RAPID PROTOTYPING SYSTEMS:

STEREO LITHOGRAPHY APPARATUS (SLA): Specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages.

SOLID GROUND CURING (SGC): Specifications, process, working principle, applications, advantages and disadvantages.

UNIT – III:

SOLID-BASED RAPID PROTOTYPING SYSTEMS:

LAMINATED OBJECT MANUFACTURING (LOM): Specifications, process, working principle, applications, advantages and disadvantages.

FUSED DEPOSITION MODELLING (FDM): Specifications, process, working principle, applications, advantages and disadvantages.

UNIT – IV:

POWDER BASED RAPID PROTOTYPING SYSTEMS:

SELECTIVE LASER SINTERING (SLS): Specifications, process, working principle, applications, advantages and disadvantages.

THREE DIMENSIONAL PRINTING (3DP): Specifications, process, working principle, applications, advantages and disadvantages.

UNIT – V:

RAPID TOOLING: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting, 3D Keltool process. Direct rapid tooling: direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

UNIT – VI:

RP APPLICATIONS: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewellery industry, coin industry, GIS application, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis, design and production of medical devices, forensic science and anthropology, visualization of bimolecular.

TEXT BOOK:

1. Rapid prototyping: Principles and Applications – Chua C.K., Leong K.F. and LIM C.S, World Scientific publications.
2. Rapid Prototyping & Manufacturing – Paul F.Jacobs, ASME Press.

REFERENCE BOOKS:

1. Rapid Manufacturing – D.T. Pham and S.S. Dimov, Springer.
2. Rapid Automated Prototyping: An Introduction Industrial Press Inc., New York.
3. Wholers Report 2000 – Terry Wohlers, Wohlers Associates.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ELECTIVE -III ADVANCED MECHANICS OF SOLIDS							

COURSE OUTCOMES:

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

CO1: **Apply** mathematical knowledge to calculate the deformation behaviour of simple structures.

CO2: **Analyze** and solve the problems related to mechanical elements by using Winkler-Bach theory.

CO3: **Identify** the Shear centre for different sections.

CO4: **Analyze** the Centrifugal Stresses in rotating Discs.

CO5: **Analyze** the Plane Stress and Principal Stresses for Inclined sections.

CO6: **Design** of shafts, cylinders and spherical shells by using theories of failure**.**

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 – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II:

STATICALLY INDETERMINATE BEAMS: Introduction, Fixed and propped cantilever beams -Analysis by the differential equations of the Deflection curve, Moment Area Method.

Continuous Beams: Introduction, Clapeyron's theorem of three moments, Beams with constant and varying moments of inertia.

UNIT – III:

SHEAR CENTRE: Bending Axis and Shear Centre, Position of Shear Centre, Shear flow, Shear Centre of Channel section, Angle section, T- section and I- section.

UNIT – IV:

CENTRIFUGAL STRESSES: Introduction, Rotating Ring, Rotating Disc, Rotating Disc of uniform strength.

UNIT – IV:

ANALYSIS OF PLANE STRESS: Stresses on inclined Sections, Plane Stress, Principal Stresses and Maximum Shear Stress. Mohr's Circle for Plane Stress. Hooke's Law for Plane Stress.

UNIT – VI:

THEORIES OF FAILURE: Failure Theories, Application to design of shafts. Cylinders and Spherical Shells: Stresses and strains in thin cylinders, Thin spherical shell.

TEXT BOOK:

1. Strength of materials by Sadhu Singh, Khanna Publishers, 11th Edition.
2. Strength of Materials R.K.Bansal, Fifth edition, Laxmi Publishers, 2012

REFERENCES:

1. Engineering Mechanics of Solids by E.P.Popov, PHI, 2nd Edition.
2. Strength of Materials by S. Ramamrutham, DhanpatRai Publishing Company (P)
3. Ltd, 18th Edition. Introduction to Solid Mechanics by I.H. Shames, PHI, 3rd Edition.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ELECTIVE -III **PRODUCTION PLANNING AND CONTROL**							

COURSE OUTCOME:

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

CO1: **Apply** the systems concept for the design of production and service systems.
CO2: **Make** use of forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques.
CO3: **Analyze** the principles and techniques of inventory management.
CO4: **Analyze** the routing procedure and able to prepare bill of material.
CO5: **Importance** of scheduling and make use of Gantt chart to solve scheduling problems.
CO6: **Identify** dispatching procedure and make use of computer in production planning and control.

UNIT – I:

INTRODUCTION

Introduction: Definition, objectives and functions of production planning and control, elements of production control, types of production, organization of production planning and control department, internal organization of department.

UNIT – II:

FORECASTING: Forecasting, importance of forecasting, types of forecasting, their uses general principles of forecasting, forecasting techniques, qualitative methods and quantitive methods.

UNIT – III:

INVENTORY MANAGEMENT

Inventory control, Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system, Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Elements of Just In Time Systems and kanban system-Fundamentals of MRP II and ERP.

UNIT – IV:

ROUTING : Routing, definition, routing procedure, route sheets, bill of material, factors affecting routing procedure, schedule, definition, difference with loading.

UNIT – V:

PRODUCTION SCHEDULING: Production Control Systems-Loading and scheduling, Master Scheduling-Scheduling rules, Gantt charts-Basic scheduling problems, Line of balance, Flow production scheduling Batch production scheduling.

UNIT – VI:

DISPATCHING: Dispatching, activities of dispatcher, dispatching procedure, follow up, definition, reason for existence of functions, types of follow up, applications of computer in production planning and control.

TEXT BOOK:

1. Elements of Production Planning and Control, Samuel Eilon.
2. Production Planning and Control, Mukhopadyay , PHI.

REFERENCES:

1. Production Planning Control and Industrial Management, K.C.Jain& L.N. Aggarwal, Khanna Publishers, 6th Edition, 2008.
2. Production and Operations Management, N.G. Nair,Tata McGraw-Hill, 2004.
3. Theory and Problems in Production & Operations Management, S.N.Chary, Tata McGrawHill, 2003.

IV B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	25	50	75	2
CAD/ CAM LAB							

COURSE OBJECTIVES:

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

CO1: Develop of part drawings for various components in the form of orthographic and isometric views by using modelling package.

CO2: Make use of Hexagonal Nut, Connecting rod, and Piston by using 3D Printer.

CO3: Determine the displacement, maximum, minimum stresses induced in beams and 2D truss elements by using ANSYS.

I. DRAFTING:

Development of part drawings for various components in the form of orthographic and isometric, representation of dimensioning and tolerances scanning and plotting. Study of script, DXE and IGES files…

1. To develop the Isometric view of 3D part drawings various components by using any modeling package.
2. To generate the 3D model of Machine components shown in figure by using PROTRUSION (Sweep) option in any solid modeling package.

II. 3D-PRINTING:

3. To Manufacture Hexagonal Nut by using 3D Printer.

4. To Manufacture Connecting rod, Piston by using 3D Printer.

III. ANALYSIS:

Analysis software enables you to solve complex structural engineering problems and make better, faster design decisions. With the finite element analysis (FEA) tools available in the suite, you can customize and automate solutions for your structural mechanics problems and parameterize them to analyze multiple design scenarios. You can connect easily to other physics analysis tools for even greater fidelity. ANSYS structural analysis software is used throughout the industry to enable engineers to optimize their product designs and reduce the costs of physical testing.

5. To find the deflections at the nodes and to draw the sheer force and bending moment diagram of beam shown in figure by using ANSYS.

6. To determine the Deflection and Member forces of a given 2D truss by using ANSYS.

7. To find the displacement, maximum, minimum stresses induced in a given cantilever beam with uniformly distributed load and point loads and draw the shear force and bending moment diagrams by using ANSYS tool, also list the results according to the given loads.

8. Estimation of natural frequencies and mode shapes Harmonic response of 2D beam by using ANSYS.

IV. CAM:

9. Prepare a Stepped Turned component on X-L Turn CNC machine.

10. Prepare a Grooved and Drilled component on X-L Turn CNC machine.

11. Prepare a “STAR SYMBOL” for a given component on X-L Mill CNC machine.

IV B.TECH II SEMISTER

IV B.Tech - II SEMESTER COURSE STRUCTURE

S. No	Subject Name	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Mechatronics	PC	4	-	-	40	60	100	3
1	**ELECTIVE-IV**	PE							
	Refrigeration & Air Conditioning		3	1	-	40	60	100	3
	Condition Monitoring								
	Powder Metallurgy								
	Quality and Reliability Engineering								
2	**ELECTIVE-V**	PE							
	Alternate Sources of Energy		4	-	-	40	60	100	3
	Experimental Stress Analysis								
	Geometric Modelling								
	Operations Planning and Control								
3	Project Work	PRC	-	-	-	80	120	200	10
4	Practical Training/Intern Ship	PRC	-	-	-	40	60	100	03
	TOTAL		**11**	**1**	**-**	**240**	**360**	**600**	**22**

IV B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
MECHATRONICS							

COURSE OUTCOMES:

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

CO1: Analyze the various mechatronic system components.
CO2: Examine the various sensors and its applications in mechatronics.
CO3: Select process controllers used in mechatronics.
CO4: Evaluate the mechatronic system design for various engineering application.
CO5: Apply the concepts of mechatronics for various applications.
CO6: Analyze different logics and logical controls**.**

UNIT – I:

INTRODUCTION: Multi-disciplinary Scenario, Origins, Evolution of Mechatronics, An overview of Mechatronics, Introduction to Manufacturing, Design.

System modelling: Introduction, system modelling, mechanical system, translational mechanical system with spring, damper and mass, Rotational mechanical system with spring, damper and mass; electrical system, modelling electric motor, fluid system, thermal systems, modeling pneumatic actuator.

UNIT – II:

SENSORS AND TRANSDUCERS: Introduction and background, difference between transducer and sensor, transducers types, transduction principle, photoelectric transducers, thermistors, thermo devices, thermo couple, inductive transducers, capacitive transducers, pyroelectric transducers, piezoelectric transducers, Hall-effect transducers, Fibre optic transducers.

UNIT – III:

ACTUATORS: Introduction, actuator types and application areas, mechanical actuation systems, Electrical actuating systems - DC motors, AC motors, stepped motor, solid state switches, solenoids; Fluid power actuators, piezoelectric actuators.

UNIT – IV:

DIGITAL LOGIC: Digital logic, number systems, logic gates, Boolean algebra, karnaugh maps, application of logic gates, sequential logic.

UNIT – V:

ADVANCED APPLICATIONS IN MECHATRONICS: Sensors for condition monitoring, mechatronic control in automated manufacturing, artificial intelligence in mechatronics, fuzzy logic applications in mechatronics, micro sensors in mechatronics.

UNIT – VI:

Dynamic models and analogies, system response. Process controllers-Digital controllers, programmable logic controllers, design of mechatronic systems and future trends

TEXT BOOK:

1. Mechatronics system design by DevdasShetty and Richard A. Kolk, PWS publishing company.

REFERENCES:

1. Mechatronics: Principles, concepts and applications by Nitaigour Premchand Mahalik, Tata – McGraw Hill Publishing Company Ltd.
2. Mechatronics by Bolton, Pearson Education.
3. Mechatronics by Bardley D.A, Dawson D, Buru N.C and Loader A.J. Chapman and HALL

IV B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3

ELECTIVE-IV
REFRIGERATION & AIR CONDITIONING
(Refrigeration and Psychrometric tables and charts allowed)

COURSE OUTCOMES:

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

CO1: **Analyze** the concepts of refrigeration and their applications.
CO2: **Evaluate** the vapour compression refrigeration system on T-S and P-h charts
CO3: **Identify** the function of each component of vapour compression refrigeration system.
CO4: **Analyze** the vapor absorption system and steam jet refrigeration system.
CO5: **Examine** different air conditioning methods and its applications.
CO6: **Categorize** different components of air conditioning plant.

UNIT – I:

INTRODUCTION TO REFRIGERATION: Necessity and applications, unit of refrigeration and C.O.P., Mechanical refrigeration, types of ideal cycles of refrigeration.

AIR REFRIGERATION: Bell Coleman cycle, open and dense air systems, refrigeration systems used in aircrafts and problems.

UNIT – II:

VAPOUR COMPRESSION REFRIGERATION: Working principle and essential components of the plant, 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, numerical problems.

UNIT – III:

REFRIGERANTS, Desirable properties, classification, refrigerants used, nomenclature, ozone depletion, global warming. VCR SYSTEM COMPONENTS: Compressors, general classification, comparison, advantages and disadvantages. Condensers, classification, working principles, evaporators, classification, working principles, expansion devices, types, working principles.

UNIT – IV:

VAPOR ABSORPTION SYSTEM: Calculation of maximum COP, description and working of NH3, water system and Li Br, water (Two shell & Four shell) System, principle of operation three fluid absorption system, salient features.

STEAM JET REFRIGERATION SYSTEM: Working Principle and basic components. Principle and operation of (i) thermoelectric refrigerator (ii) vortex tube.

UNIT – V:

INTRODUCTION TO AIR CONDITIONING: Psychometric properties & processes, characterization of sensible and latent heat loads, need for ventilation, consideration of infiltration, load concepts of RSHF, GSHF problems, concept of ESHF and ADP temperature. Requirements of human comfort and concept of effective temperature comfortchart, comfort air conditioning, requirements of industrial air conditioning, air conditioning load calculations.

UNIT – VI

AIR CONDITIONING SYSTEM COMPONENTS: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers fans and blowers. heat pump, heat sources, different heat pump circuits.

TEXT BOOKS:

1. A Course in Refrigeration and Air conditioning, SC Arora & Domkundwar ,Dhanpatrai.
2. Refrigeration and Air Conditioning, CP Arora, TMH.

REFERENCES:

1. Refrigeration and Air Conditioning, Manohar Prasad, New Age.
2. Principles of Refrigeration -Dossat , Pearson Education.
3. Basic Refrigeration and Air-Conditioning – Ananthanarayanan , TMH.

IV B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3

ELECTIVE-IV
CONDITION MONITORING

COURSE OUTCOMES:

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

CO1: Determine amplitudes, period, frequency, displacement, velocity, acceleration, natural frequencies and resonance of SDOF and MDOF systems.

CO2: Evaluate vibration measurements and analysis using instrumentation recorders/data loggers.

CO3: Analyze vibration measurements for common machine faults with case studies.

CO4: Analyze thermal images, report generation and thermography applications.

CO5: Discuss oil and wear debris analysis and ultrasonic monitoring and analysis.

CO6: Analyze about the case studies of two stage compressor, cement mill foundation, i.d fan, sugar centrifugal, cooling tower fan, air separator, and preheater fan.

UNIT – I:

BASICS OF VIBRATION: Basic motion: amplitudes, period, frequency, basic parameters: displacement, velocity, acceleration, units (including Db scales) and conversions, Mass, spring and damper concept, Introduction to SDOF and MDOF systems, Natural frequencies and resonance, Forced response.

UNIT – II:

VIBRATION MEASUREMENTS AND ANALYSIS: Transducers and mounting methods, data acquisition using instrumentation recorders/data loggers, time domain signal analysis, orbit analysis, Filters, Frequency domain analysis (Narrow band FFT analysis), Nyquist criteria, Sampling, aliasing, windowing and averaging.

VIBRATION MEASUREMENT AND ANALYSIS: Use of phase; bode, polar and water fall plots, constant percentage band width analysis (1/3 and1/1 Octave analysis), envelope detection /spike energy analysis, cepstral analysis, advances in analysis (PC based and portable instruments for vibration analysis).

UNIT – III:

Fault Diagnosis, Interpreting vibration measurements for common machine faults, imbalance, misalignment, mechanical looseness, bearing and gearing faults, faults in induction motors, resonances, some case studies, static and Mechanical Engineering dynamic balancing, international standards for vibration condition monitoring.

UNIT – IV:

THERMOGRAPHY: The basics of infrared thermography, differences in equipment and specific wave length limitations, application of it to: electrical inspection, mechanical inspection, energy conservation, how to take good thermal images, hands-on demonstrations focusing on proper camera settings and image interpretation, analysis of thermal images and report generation, study of thermography applications

UNIT – V:

OIL AND WEAR DEBRIS ANALYSIS: Basics of oil analysis, monitoring the condition of oil, lubricant analysis, physio-chemical properties, moisture, tan tbn, wear debris analysis, particle counting, spectroscopy, uses &limitations.

ULTRASONIC MONITORING AND ANALYSIS: Ultrasonic monitoring (leak, crack and thickness) basics of ultrasonic monitoring, ultrasonic theory, test taking philosophy, ultrasonic theory, application of ultrasound to: air leaks, steam trap testing, bearing lubrication, electrical inspection.

UNIT – VI:

CASE STUDIES: Two stage compressor, cement mill foundation, I.D Fan, Sugar centrifugal, Cooling tower fan, Air separator, Preheater fan.

TEXT BOOKS:

1. The Vibration Analysis Handbook, J I Taylor (1994)
2. Machinery Vibration Condition Monitoring, Lynn, Butterworth (1989)
3. Mechanical Vibration Practice With Basic Theory V.Ramamurti, Narosa publishing house CRC Press.

REFERENCE BOOKS:

1. Machinery Vibration: Measurement and Analysis. Victor Wowk (1991).
2. Mechanical fault diagnosis and condition monitoring, RA Collacott (1977).
3. The Vibration Monitoring Handbook (Coxmoor's Machine & Systems Condition Monitoring) (1998).

IV B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3
ELECTIVE-IV POWDER METALLURGY							

COURSE OUTCOME:

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

CO1: Analyze the concepts of powder metallurgy and powder production methods.
CO2: Distinguish the relation between powder production method and powder characteristics.
CO3: Analyze the basic methods of Powder compaction for green compact.
CO4: Analyse the powder forming techniques.
CO5: Develop mechanical properties for sintering.
CO6: Minimize defects in sintered products.

UNIT – I:

INTRODUCTION

Historical and modern developments in powder metallurgy. Advantages, limitations and applications of powder metallurgy. Basic steps for powder metallurgy.

METAL POWDER PRODUCTION METHODS

Atomization, Reduction from oxide, Electrolysis, Crushing, Milling, and Condensation of metal vapour, Hydride and carbonyl processes, Mechanical Alloying, New developments.

UNIT – II:

POWDER CHARACTERIZATION

Powder conditioning, fundamentals of powder compaction, density distribution in green compacts, compressibility, green Strength, pyrophorocity and toxicity, relation between powder production method and powder characteristics.

UNIT – III:

POWDER COMPACTION

Methods Basic aspects, types of compaction presses, compaction tooling and role of lubricants, Single and double die compaction, isostatic pressing, and hot pressing, powder injection moulding.

UNIT – IV:

POWDER FORMING

Powder rolling, powder pressing-hot, uniaxial, isostatic, powder forging, powder extrusion, hydro plastic forming, slip casting, tape casting and explosive forming technique.

UNIT – V:

SINTERING

Basics of sintering, driving forces of sintering, stages of sintering, solid state sintering, liquid phase sintering, pore morphology, sintering mixed powders, sintering techniques, sintering atmosphere, post-sintering operations, issues with nanopowders during compaction and sintering, sintering mechanisms, sintering diagrams.

UNIT – VI:

SINTEREDPRODUCTS

Study of sintered bearings, cutting tools, metallic filters, friction and antifriction parts and electrical contact materials. Defects in Powder metallurgy processed materials and their processing to minimize defects: Friction stir processing etc.

TEXT BOOKS:

1. Powder Metallurgy Practice and Applications, Sands H.L and Shakespeare C.R.,George Newness Ltd., London, 1996.
2. Powder Metallurgy, Sinha A.K., -Dhanpat Rai, 1982

REFERENCE BOOKS:

1. Principles of Powder Metallugy, Jones W.D., Edward Arnold and Co., 1939.
2. Powder Metallurgy Technology, G.S. Upathaya, Cambridge Inb science Publications, 1997.

IV B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	40	60	100	3

ELECTIVE-IV
QUALITY AND RELIABILITY ENGINEERING
(SQC tables can be used in the examination)

COURSE OUTCOMES:

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

CO1: **Analyze** the quality engineering in product design and production process
CO2: **Apply** control charts to improve the process quality.
CO3: **Develop** a simple sampling plan, construct its OC curve
CO4: **Determine** the tolerance for N type, L type, S type.
CO5: **Evaluate** the design by tests, hazard models, linear, raleigh, weibull. and failure data analysis
CO6: **Elaborate** the economics of reliability engineering, replacement of items, maintenance costing and budgeting..

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.

UNIT – II:

Statistical process control X , R, p, c charts, other types of control charts, process capability, process capability analysis, process capability index.

UNIT – III:

Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plans.

UNIT – IV:

Loss function, tolerance design-N type, L type, S type, determination of tolerance for these types. Online quality control, variable characteristics, attributes characteristics, parameter design. Quality function deployment, house of quality, QFD matrix, total quality management concepts. Quality information systems, quality circles, introduction to ISO 9000 standards.

UNIT – V:

Reliability, Evaluation of design by tests, Hazard Models, Linear, Raleigh, Weibull. Failure Data Analysis, reliability prediction based on weibull distribution, Reliability improvement in mechanical Engineering.

UNIT – VI:

Complex system, reliability, reliability of series, parallel & standby systems & complex systems & reliability prediction and system effectiveness. Maintainability, availability, economics of reliability engineering, replacement of items, maintenance costing and budgeting, reliability testing.

TEXT BOOKS:

1. Reliability Engineering, LS Srinath, Affiliated East West Pvt.Ltd.
2. Statistical quality control - M.S Mahajan by Dhanpat Rai publications

REFERENCE BOOKS:

1. Statistical Quality Control: A Modern Introduction “Montgomery, Wiley.
2. Quality Engineering in Production Systems, G Taguchi, McGrawHill. Reliability Engineering, E. Bala Guruswamy, Tata McGraw Hill.

IV B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ELECTIVE-V **ALTERNATE SOURCES OF ENERGY**							

COURSE OUTCOMES:

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

CO1: **Identity** different sources of renewable energy.
CO2: **Distinguish** the different solar collecting/storage devices and its working.
CO3: **Discuss** different wind energy systems and wind data measurements.
CO4: **Analyze** the biomass to energy conversion methods.
CO5: **Discuss** the sources of biofuels that can be used in IC engines
CO6: **Categorize** different geothermal energy sources and harvesting of these sources

UNIT – I:

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

UNIT – II:

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – III:

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications, solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – IV:

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, types of winds, wind data measurement.

UNIT – V:

BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, biofuels, I.C.Engine operation and economic aspects.

UNIT – VI:

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

TEXT BOOKS:

1. Sukhatme S.P. and J.K.Nayak, Solar Energy, Principles of Thermal Collection and Storage, TMH
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2006

REFERENCE BOOKS:

1. Solar Power Engineering, B.S Magal Frank Kreith& J.F Kreith.
2. Principles of Solar Energy, Frank Krieth& John F Kreider.
3. Non-Conventional Energy, Ashok V Desai, Wiley Eastern.
4. Renewable Energy Technologies, Ramesh & Kumar, Narosa Publishers

IV B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ELECTIVE-V EXPERIMENTAL STRESS ANALYSIS							

COURSE OUTCOMES:

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

CO1: **Determine** the maximum and minimum principle stress from Mohr's circle.
CO2: **Measure** and record various frequencies for dynamic recording.
CO3: **Analyze** the three dimensional Photo elasticity by Frozen-stress method and scattered-light method.
CO4: **Analyze** the ceramic based and resin based brittle coatings
CO5: **Evaluate** the mechanism of formation of Moire fringes
CO6: **Determine** the Fringe-order in coatings by stress separation methods..

UNIT – I:

INTRODUCTION: Stress, strain, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, stress functions, Mohr's circle for stress strain, Three-dimensional stress strain relations.

UNIT – II:

STRAIN MEASUREMENT AND RECORDINGS: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits. Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

UNIT – III:

PHOTO ELASTICITY: Photo elasticity, Polariscope, Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials, isochromatic fringes, Isoclinic.

Three dimensional Photo elasticity: Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear difference method in three dimensions, applications of the Frozen-stress method, the scattered-light method.

UNIT – IV:

BRITTLE COATINGS: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, and resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.

UNIT – V:

MOIRE METHODS: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

UNIT – VI:

BIREFRINGENT COATINGS: Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

TEXT BOOKS:

1. Theory of Elasticity, Timoshenke and Goodier Jr., McGraw-Hill
2. Experimental stress analysis, Dally and Riley, McGraw-Hill.

REFERENCES:

1. A treatise on Mathematical theory of Elasticity, LOVE .A.H.
2. Experimental stress analysis, Video course by K.Ramesh / NPTEL.

IV B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ELECTIVE-V GEOMETRICAL MODELING							

COURSE OUTCOMES:

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

CO1: Determine various mathematical equations to represent curves.
CO2: Apply the cubic splines in modelling of a product.
CO3: Build the Bezier splines in modelling of a product.
CO4: Develop B-spline cures in modelling a product.
CO5: Utilize appropriate surfaces in preparing a product
CO6: Utilize appropriate synthetic curves in modelling process.

UNIT – I:

INTRODUCTION: Definition, explicit and implicit equations, parametric and non-parametric equations-straight line, circle, ellipse, parabola and hyperbola non parametric.

UNIT – II:

CUBIC SPLINES: Algebraic and geometric form of cubic spline, tangent vectors, parametric space of a curve, blending functions, four point form, reparametrization, truncating and subdividing of curves. Graphic construction and interpretation, composite pc curves.

UNIT – III:

BEZIER CURVES: Control polygons and Bernstein basis, equations of Bezier curves, properties, first and second derivatives at the ends, Continuity aspects.

UNIT – IV:

B-SPLINE CURVES: periodic, open and non-uniform knot vectors and corresponding curves, Rational B-splines, NURBS, and Quadratic variety.

UNIT – V:

SURFACES: Bi-cubic surfaces, Coon's surfaces, Bezier surfaces, B-Spline surfaces, surfaces of revolutions, sweep surfaces, ruled surfaces, tabulated cylinder, bilinear surfaces, Gaussian curvature.

UNIT – VI:

SOLIDS AND SOLID MODELING CONCEPTS: Tricubic solid, Algebraic and geometric form. Wire frames, boundary representation, half space modeling, spatial cell, cell decomposition, classification problem

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TEXT BOOKS:

1. "CAD/CAM, Theory and Practice", Ibrahim Zeid, Tata McGraw Hill,2009.
2. "Mathematical Elements for Computer Graphics" ,Roger &Adams, Tata McGrawHill,2nd Edition.

REFERENCES:

1. CAD / CAM / CAE, E.Zimmers & M.Groover, Pearson Education.
2. Geometric Modeling, Michael E. Mortenson, Industrial Press Inc.,U.S.

IV B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	40	60	100	3
ELECTIVE-V **OPERATIONS PLANNING AND CONTROL**							

COURSE OUTCOMES:

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

CO1: **Analyze** the production forecast techniques.
CO2: **Identify** better economic order quantity to choose the best process planning method
CO3: **Develop** the best production planning method
CO4: **Develop** the best aggregate planning method.
CO5: **Analyze** the materials requirement planning.
CO6: **Analyze** the concepts of production control and line balancing.

UNIT – I:

PRODUCTION FORECASTING: Use of forecast, types of forecasts, statistical forecasting, time series analysis models, effects of trend, seasonal and irregular movements in the model, uncertainty of forecast, monitoring forecast, need for planning and market research.

UNIT – II:

PROCESS PLANNING: Prerequisites of process planning, steps in process planning, break even analysis- analysis- new designs, product mix machine or process selection and make & buy decisions, study of route sheet preparation, economics order quantity of manufacture.

UNIT – III:

PRODUCTION PLANNING: Benefits and basic functions for production planning, project planning various production planning, types of production and their basic characteristics, identification of different production activities, capacity level of each activity, determination of standard hours available, master schedule

UNIT – IV:

AGGREGATE PLANNING: Pure and mixed strategies, Choice of APP, Examples. Master Production Schedule: Concept, Strategies, Chase sales, Lot-for-lot

UNIT – V:

MATERIALS REQUIREMENT PLANNING: Inputs to MRP, Structure of MRP, Examples of MRP routing and scheduling in job, lot and mass production, jobs sequencing and machine loading line of balance technique.

UNIT – VI:

PRODUCTION CONTROL: Functions of production control, effects of production control, dispatching and follow up in job, lot and mass production, evaluating a production control system, designing the production control organization

LINE BALANCING: Operation sequencing and assembly line balancing, minimum number of theoretical workstations, efficiency of assembly line using heuristic approach.

TEXT BOOKS:

1. The fundamentals of production planning and control, Stephen N.Chapmen, Pearson Education.
2. Operations planning and control, James Harnsberger, R.D. Irwin, the University of Wisconsin-Madison.

REFERENCES:

1. Operations planning and control, Martin K. Starr, Cengage publication
2. Elements of production planning and control, Eilon, Macmillan publication
3. Operations planning and control, James Harnsberger, R.D. Irwin, the University of Wisconsin-Madison.

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