SRI VENKATESA PERUMAL
COLLEGE OF ENGINEERING & TECHNOLOGY
| AUTONOMOUS | ACCREDITED BY NAAC |
RVS Nagar, K.N Road, Puttur, Chittoor dist, AP. I www.svpcet.org

Academic Regulations (R18) for
B.Tech (Regular-Full time)
CHOICE BASED CREDIT SYSTEM (CBCS)

(Effective for the students admitted into I year from the Academic Year 2018-19 onwards)

NOTE: The regulations below are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of students (including those already undergoing the programme) as may be decided by the Academic Council. The Jawaharlal Nehru Technological University Anantapur, Ananthapuramu shall confer B.Tech. Under Graduate degree to candidates who are admitted to the Bachelor of Technology Programs and fulfill all the requirements for the award of the degree.

Preliminary Definitions and Nomenclature

In the following Regulations, unless the context otherwise requires:

(i) "**Programme**" means Degree Programme that is B.Tech Degree Programme.

(ii) "**Branch**" means specialization or discipline of B.Tech Degree Programme, like Mechanical Engineering, Electrical and Electronics Engineering etc.

(iii) "**Course**" means a theory or practical subject that is normally studied in a Semester, like Mathematics, Physics, etc.

(iv) "**College/Institute**" means Sri Venkatesa Perumal College of Engineering & Technology, Puttur.

(v) "**University**" means Jawaharlal Nehru Technological University Anantapur, Ananthapuramu.

1. Admission Procedure

Admissions are made to the first year of Four year B.Tech. Degree programme as per the norms of A.P. State Council of Higher Education (APSCHE), Government of Andhra Pradesh.

2. Program Pattern

2.1. The medium of instruction, examinations and project reports shall be in English.

2.2 The entire program of study is for four academic years. All four academic years shall be on semester pattern.

2.3 A student eligible to appear for the end examination in a course, but absent or has failed in the end examination may appear for that course at the next supplementary examination when offered.

2.4 When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

2.5 The minimum instruction days including exams for each semester shall be 90 days.

3. Award of B.Tech. Degree

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

3.1 Pursues a course of study for not less than four academic years and in not more than eight academic years from the year of their admission. However, for the students availing Gap year facility this period shall be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation.

3.2 Registers for 160 credits and secure all 160 credits.

3.3 Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. Course and their admission stands cancelled.

Credits

Course	Credits / Course
Lecture (L)	**3 or 4**
Tutorial (T)	**1**
Practical (P)	**1.5**
CRT	**1**
Seminar	**1**
Project (Mini)	**1**
Project Phase-I	**4**
Project Phase-II	**9**

Seminar: 2 technical Presentations + 1 participation in external technical symposia + participation in one 2-day workhop, In the place of one technical presentation, student can choose to participate one day in NSS acitivity.

4. Branches of study:

With the approval of AICTE & JNTUA, following courses are offered for the B.Tech. Programme from 2018-19

S.No.	Name of the Branch	Branch Code
1	Civil Engineering	01
2	Electrical and Electronics Engineering	02
3	Mechanical Engineering	03
4	Electronics and Communication Engineering	04
5	Computer Science and Engineering	05

and any other course as approved by the authorities of statutory bodies of the college from time to time.

5. Distribution and Weightage of Marks

5.1 The performance of a student in each semester shall be evaluated through internal evaluation and /or an external evaluation conducted semester wise.

5.2 Performance evaluation in each course (theory/ practical) shall be based on a total of 100 marks, of which the relative weightage for internal evaluation and end semester examination shall be 30% and 70% respectively.

5.3 Internal Evaluation

The total internal weightage for theory courses is 30 marks with the following distribution.

a) 20 marks for descriptive test.
b) 10 marks for objective test.

For all theory courses there shall be two mid-term tests in each semester. The duration of mid-term test shall be 1 hr 50 minutes. In that, 90 minutes will be for descriptive test and 20 minutes for objective test. The descriptive test consists of 3 questions with individual choice (‘either’, ‘or’ type) for 10 marks each. The total marks 30 shall be scaled down to 20 marks. The objective test consists of 20 objective questions for 10 marks in 20 minutes duration. Together, the maximum marks for each mid-term test shall be 30. First mid-term test shall be conducted for 50% of the syllabus and second mid-term for the remaining syllabus.

Among the two midterm examinations 80% weightage will be given for the better performance and 20 % for the other. The final mid-term marks will be the addition of these two.

Example: If a student scores 23 marks and 24 marks in the first and second mid-term examinations respectively, then

Weighted Average Marks = 24 x 0.8 + 23 x 0.2 = 23.8, rounded to 24 Marks.

Note: The marks of any fraction shall be rounded off to the next higher mark.

5.4 Practical Courses

The total internal weightage for Practical courses is 30 marks. The marks can be evaluated based on Day to Day assessment.

The end semester examination shall be conducted for 70 marks by the laboratory faculty concerned and one senior faculty of the same department nominated by the Principal.

In a practical course consisting of two parts (ex: Engineering and IT workshop Lab), the internal examination shall be evaluated for 30 marks in each part and final internal marks shall be arrived by considering the average of marks obtained in the two parts. End semester examination shall be conducted for 70 marks in each part and final marks shall be arrived by considering the average of marks obtained in the two parts.

5.5 For the subjects having design and /or drawing, such as Engineering drawing, Estimation, Design and Drawing of Irrigation Structures, etc., the distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination.

5.5.1 Within internal evaluation, 10 marks will be for day to day work in the class that shall be evaluated by the concerned subject teacher based on the reports / drawing sheets submitted in the class.

5.5.2 The remaining 20 marks will be based on the student's performance in two mid-term tests of 2 hours duration each. Among the two mid-term examinations 80% weightage will be given for the better performance and 20% for the other. The final mid-term marks will be the sum of these two.

5.6 The laboratory records shall be preserved in the respective department as per the institution norms and should be produced to the committee as and when the same is asked for.

5.7 The student has to complete mandatory courses with a minimum of 40% of marks in internal examination to award the degree and there will be no external examination. The evaluation for mandatory course shall be carried out for a maximum of 30 marks.

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5.8 End Semester Examination

- There shall be 6 questions and all questions are compulsory.
- First question shall contain 10 compulsory short answer questions for a total of 20 marks such that question carries 2 marks. There shall be 2 short answer questions from each unit.
- In each of the questions from 2 to 6, there shall be 'either', 'or' type questions each one carry 10 marks. Student shall answer any one of them.
- Each of these questions from 2 to 6 shall cover one unit of the syllabus.

The duration of theory/practical end semester examination shall be 3 hours.

- End semester examination for theory courses consisting of two parts of different courses, for ex: Basic Electrical & Electronics Engineering shall have the following pattern:
    a. Question paper shall be in two parts viz., Part A and Part B with equal weightage.
    b. In each part there shall be 3 either-or type questions for 12, 12 and 11 marks.

5.9 Project Phase - I

Project Phase – I is introduced at IV year I Semester. The objective of Project Phase - I is to enable group of students to take up investigative study in the broad field of relevant engineering branch, theoretical/practical problem to be assigned by the Department under the guidance of a Project Supervisor. The group of students should submit a report and present a seminar at the end of the semester before Project Supervisor and Internal Department Committee (IDC) consists of Head of Department (HOD), Project Coordinator and a senior faculty of the department nominated by HOD. The report submission and oral presentation shall be evaluated for 100 marks by Project Supervisor and IDC.

5.10 Project Phase - II

The objective of Project Phase - II which is continued in IV year II semester is to enable the student to extend further the investigative study taken up under Project Phase - I, and to provide a solution for the theoretical/practical problem**.**

Out of the total 200 marks for the Project Phase - II, 60 marks shall be for internal evaluation and 140 marks for the external evaluation (Viva-voce)**.** The evaluation method of the project is as follows.

Internal Evaluation

Two reviews one at the mid of semester and the other before submitting the project report shall be conducted by IDC and Project Supervisor jointly.

External Evaluation

The external project viva-voce will be conducted by the committee consisting of HOD, Project Supervisor and External examiner nominated by the principal.

Supplementary Examinations

At the end of each Semester there will be regular examinations for the current Semester. Those students who could not clear their courses in their previous attempt can appear for the examinations under supplementary category along with the regular students after registering themselves at the examination branch. Supplementary examinations for the all the other Semesters other than the current one will also be conducted at the same time.

However, Advanced Supplementary examinations will be conducted for IV-II semester examinations.

5.11 Summer Internship / mini project

The student shall do either a summer internship or a mini-project during their course of study preferably during his/her summer vacation immediately after 6^{th} semester.

There shall be 6 weeks duration to complete summer internship during summer vacations. The total internal weightage for internship course is 50 marks and will be evaluated based on day to day assessment by concern industry.

In place of summer internship, a student can also do a mini-project within the college under the supervision of the department faculty.The weightage of marks is similar to that of internship.

The student shall secure a minimum of 40% to pass internship / mini-project.

6. Attendance Requirements

6.1 A student shall be eligible to appear for final examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.

6.2 Shortage of attendance below 65% in aggregate shall in **NO** case be condoned.

6.3 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

6.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end semester examination of that class.

6.5 A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek re-admission for that semester when offered next.

6.6 A stipulated fee shall be payable towards condonation for shortage of attendance to the Institute as decided by the College Academic Committee.

7. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in Section No.6

7.1 A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks (i.e., 25) in the end semester examination and a minimum of 40% of marks (i.e., 40) in the sum total of the internal evaluation and end examination taken together.

7.2 A student shall be promoted from 4^{th} semester to 5^{th} semester only if he/she acquires 23 credits (i.e 40% of total credits) that have been studied up to 3^{rd} semester from the following examinations, irrespective of whether the candidates takes the end examinations or not as per the normal course of the study

B.Tech 1^{st} Sem - one regular and two supplementary

B.Tech 2^{nd} Sem - one regular and one supplementary

B.Tech 3^{rd} Sem - one regular only

7.2 A student shall be promoted from 6^{th} semester to 7^{th} semester only if he/she acquires 39 credits(i.e 40% of total credits) that have been studied up to 5^{th} semester from the following examinations, irrespective of whether the candidates takes the end examinations or not as per the normal course of the study

B.Tech 1^{st} Sem - one regular and four supplementary

B.Tech 2^{nd} Sem - one regular and three supplementary

B.Tech 3^{rd} Sem - one regular and two supplementary

B.Tech 4^{th} Sem - one regular and one supplementary

B.Tech 5^{th} Sem - one regular only

7.4 In case if student is already detained for want of credits for particular academic year as per Section No. 7.2 and 7.3 above, the student may make up the credits through supplementary exams of the above exams before the commencement of third or fourth year I semester class work respectively of next year.

7.5 A student shall register and put up minimum attendance in all 160 credits and earn all the 160 credits. Marks obtained in all 160 credits shall be considered for the calculation of aggregate percentage of marks obtained.

7.6 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. Course and their admission shall stand cancelled.

8. With–Holding of Results

If the candidate has any dues not paid to the institute or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld and he/she will not be allowed / promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

9. Grading

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below:

Table – Conversion into Grades and Grade Points assigned for Theory, Practical, Internship & Project Phase - I

Range in which the marks in the theory, practical, internship & project phase - I fall	Grade	Grade Points (GP) Assigned
≥ 90	S (Superior)	10
80-89	A (Excellent)	9
70-79	B (Very Good)	8
60-69	C (Good)	7
50-59	D (Average)	6
40-49	E (Below Average)	4
< 40	F (Fail)	0
Absent	Ab (Absent)	0

Table – Conversion into Grades and Grade Points assigned for Project Phase - II

Range in which the marks in the subject fall	Grade	Grade Points (GP) Assigned
≥ 190	S (Superior)	10
170-189	A (Excellent)	9
150-169	B (Very Good)	8
120-149	C (Good)	7
100-119	D (Average)	6
80-99	E (Below Average)	4
< 80	F (Fail)	0
Absent	Ab (Absent)	0

i. A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered.

ii. For audit courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9.1. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

(i) Semester Grade Point Average (SGPA)

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$\mathbf{SGPA\ (S_i) = \Sigma\ (C_i \times G_i) / \Sigma C_i}$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

(ii) Cumulative Grade Point Average (CGPA)

The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.,

$$\mathbf{CGPA = \Sigma\ (C_i \times S_i) / \Sigma C_i}$$

Where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- While computing the CGPA the subjects in which the student is awarded Zero grade points will also be included.
- ***Grade Point:*** It is a numerical weight allotted to each letter grade on a 10-point scale.
- ***Letter Grade:*** It is an index of the performance of students in a said course, Grades are denoted by letters S, A, B, C, D, E and F.

EXAMPLE: Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade Point)
Course-I	3	S	10	3x10 = 30
Course-II	3	A	9	3x9 = 27
Course-III	3	B	8	3x8 = 24
Course-IV	3	D	6	3x6 = 18
Course-V	2	B	8	2x8 = 16
Course-VI	1	C	7	1x7 = 7
	18			122

Thus, SGPA = 122/18 = 6.8

Illustration for CGPA

Semester	Credits	SGPA	CGPA
1	18.50	6.80	6.80
2	20.50	6.90	6.85
3	19.00	7.30	6.99
4	19.00	6.80	6.95
5	22.00	8.20	7.22
6	23.00	7.40	7.26
7	20.00	7.20	7.25
8	18.00	7.80	7.31

Thus, CGPA = $\frac{(18.5\times6.8)+(20.5\times6.9)+(19\times7.3)+(19\times6.8)+(22\times8.2)+(23\times7.4)+(20\times7.2)+(18\times7.8)}{160}$ = 7.31

10. Award of Class

After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B.Tech. Degree he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.0 < 5.5

A student with final CGPA is < 4.00 will not be eligible for the Award of the Degree.

11. Gap Year – Concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after II year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. Such proposals submitted by the students to the Principal. An evaluation committee shall be constituted by the Principal to evaluate the proposal submitted by the student and the committee shall decide whether or not to permit student(s) to avail the Gap Year.

12. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section No. 3.3 and they will be in the academic regulations into which they get re-admitted.

Candidates who were permitted with Gap Year shall be eligible for rejoining into the succeeding year of their B.Tech from the date of commencement of class work, subject to Section No. 3.3 and they will be in the academic regulations into which the candidate is presently rejoining.

13. Massive Open Online Courses (MOOCs)

The college in line with the developments in Learning Management Systems (LMS) intends to encourage the students to do online courses in MOOCs, offered internationally. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion for the course from the MOOCs providers.

Regulations for MOOCs

13.1 Institution intends to encourage the students to do two MOOC courses one in III year II Semester and the other IV year I Semester of relevant B.Tech Programme.

13.2 The respective departments shall give a list from NPTEL or any other standard providers, whose credentials are endorsed by the HOD.

13.3 Each department shall appoint Coordinators/Mentors and allot the students to them who shall be responsible to guide students in selecting online courses and provide guidance for the registration, progress and completion of the same.

13.4 A student shall choose an online course (relevant to his/her programme of study) from the given list of MOOCs providers, as endorsed by the teacher concerned, with the approval of the HOD.

13.6 The details of MOOC(s) shall be displayed in Grade card of a student, provided he/she submits the proof of completion of it to the department concerned through the Coordinator/Mentor.

13.7 Student can get certificate from SWAYAM/NPTEL. The course work should not be less than 12 weeks or student may appear for end examination conducted by the Institute.

13.8 The end examination conducted by Institution for 60 marks shall be scaled up to 100 marks.

13.9 The Provisional Degree Certificate and/or consolidated grade sheet shall be issued only to those students, who have submitted proof of completion of online/offline MOOCs for the courses they have registered with.

14. Virtual Labs

With the help of Virtual Labs the student will be given additional exposure to laboratory practice. This helps in better understanding the concepts and practical significance of engineering.

15. Choice Based Credit System (CBCS)

The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses). The CBCS provides a ‘cafeteria’ type approach in which students can take courses of their choice, learn at their own pace and adopt an interdisciplinary approach to learning.

Regulations for CBCS

15.1 The CBCS, also called as Open Electives (OEs) will be implemented in the College.

15.2 It is mandatory for Under Graduate (UG) students to study two CBCS course during IV Year II Sem of their programme by taking one course.

15.3 A student shall opt for any two courses from the list given by the institute.

15.4 A CBCS course shall be offered by a department, only when there are a minimum number of 20 students opting for that course.

16. Minor Engineering

A student shall be eligible to get Under Graduate degree with Honours or additional Minor Engineering. The following are the rules to acquire Minor Degree Engineering

- To earn a minor degree a student has to get a minimum of 20 extra credits.
- These could be acquiring through MOOCs.
- Students who have a SGPA of 8.0 or above up to 3rd semester and without any backlog subjects will be permitted to register for minor degree.
- The student has to maintain SGPA of 8.0 and above in the subsequent semesters without any backlogs to keep the minor registration active, otherwise their registration will be cancelled.

17. Student Transfers

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh from time to time.

18. General

18.1 The academic regulations should be read as a whole for purpose of any interpretation.

18.2 Malpractices rules- nature and punishments are appended.

18.3 Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.

18.4 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

18.5 The Institute, with the approval of the Academic Council, may change or amend the academic regulations / structure / credits / syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Institute.

19. Mandatory Course: A student shall persue the following four non credit mandatory courses.

i. Environmental Science ii. Induction Training

iii. Indian Constitution iv. Essence of Indian traditional knowledge.

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Academic Regulations (R18) for

B. Tech (Lateral Entry)

(Effective for the students admitted into II year from the Academic Year 2019-20 onwards)

NOTE: All the regulations adopted for B.Tech (Regular-Full Time) programme are applicable to lateral entry students in addition to the following:

1. Award of B.Tech Degree

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

i. Pursues a course of study for not less than three academic years and in not more than six academic years. However, for the students availing Gap year facility this period shall be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation.

ii. Registers for 121 credits and secure all 121 credits.

iii. Students, who fail to fulfill all the academic requirements for the award of the degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech. Course and their admission stands cancelled.

2. Minimum Academic Requirements:

Students need to acquire necessary credits to get promoted to the subsequent academic year, in addition to the attendance requirements mentioned above.

2.1 A student shall be promoted from 6^{th} semester to 7^{th} semester only if he/she acquires 24 of the credits (i.e 40% of the credits) from the courses that have been studied up to 5^{th} semester from all the regular and supplementary examinations until 5^{th} semester.

- Two regular and one supplementary examinations of 3^{rd} Semester.
- One regular and one supplementary examinations of 4^{th} Semester.
- One regular examination of 5^{th} semester.

2.2 A student shall register and put up minimum attendance in all 121 credits and earn all the 121 credits. Marks obtained in all 121 credits shall be considered for the calculation of aggregate percentage of marks obtained.

2.3 Students who fail to earn 121 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit their seat in B.Tech. Course and their admission shall stand cancelled.

3. Course Pattern:

3.1 The entire course of study is for three academic years. All years shall be on semester pattern.

3.2 A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.

3.3 When a student is detained due to lack of credits/shortage of attendance he may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

RULES FOR

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers, blue tooth or any other form of material concerned with or related to the course of the examination (theory or practical) in which he/she 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 course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(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 examination hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he/she 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 course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
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 for four consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with for feature of seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that Semester/year. The candidate is also debarred for four consecutive Semesters from class work and all Semester end examinations if his involvement is established. Otherwise the candidate is debarred for two consecutive semesters from class work and all end 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/she 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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also

		debarred for two consecutive Semesters from class work and all Semester end 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 course.
6	Refuses to obey the orders of the any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walkout 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that Semester. If candidate physically assaults the invigilator or/officer in charge of the examination, then the candidate is also barred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	examination.	
7	Leaves the examination 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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all Semester end 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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 colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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 course and all other courses the candidate has appeared including practical examinations and project work of that Semester examinations depending on the recommendation of the committee.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal for further action to award suitable punishment.	

Note:

i. All malpractices cases are to be handled by the Chief Controller with a committee consist of Controller of Examinations, HOD concerned and subject expert.

ii. Whenever the performance of a student is cancelled in any course/ courses due to Malpractice, he has to register for the End Examination in those course/courses consequently and has to fulfill all the norms required for award of Degree.

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DEPARTMENT OF MECHANICAL ENGINEERING

CURRICULUM AND SYLLABUS UNDER R18 REGULATION

B.Tech I Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	18BSBH01	Mathematics-I	3	1	0	4
2	18BSBH10	Engineering Physics	3	0	0	3
3	18ES0301	Engineering Graphics & Design	2	0	4	4
4	18HSBH01	Technical English	3	0	0	3
5	18BSBH11	Physics lab	0	0	3	1.5
6	18HSBH02	English Language and communication skills lab	0	0	3	1.5
7	18ES0302	Engineering & IT Workshop Practice	0	0	3	1.5
		Total	**11**	**1**	**13**	**18.5**

B.Tech II Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	18BSBH02	Mathematics-II	2	1	0	3
2	18BSBH12	Engineering Chemistry	3	0	0	3
3	18ES0501	Problem Solving Using ‘C’	3	1	0	4
4	18ES0206	Basic Electrical Engineering	3	0	0	3
5	18ES0101	Engineering Mechanics	3	0	0	3
6	18BSBH13	Engineering Chemistry lab	0	0	3	1.5
7	18ES0502	Problem Solving Using ‘C’ lab	0	0	3	1.5
8	18ES0207	Basic Electrical Engineering Lab	0	0	3	1.5
9	18MCBH02	Environmental Science (Mandatory Course)	2	0	0	0
		Total	**16**	**2**	**9**	**20.5**

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DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech III Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	18BSBH03	Mathematics-III	3	0	0	3
2	18ES0402	Basic Electronics Engineering	2	0	0	2
3	18PC0301	Material Science Engineering	3	0	0	3
4	18PC0302	Engineering Thermodynamics	2	1	0	3
5	18PC0303	Mechanics of Solids	3	1	0	4
6	18PC0304	Material Testing Lab	0	0	3	1.5
7	18ES0303	Machine Drawing Lab	0	0	3	1.5
8	18HSBH03	Soft Skills	0	0	2	1
9	18MCBH03	Constitution of India	2	0	0	0
		Total	**15**	**2**	**8**	**19**

B.Tech IV Semester

S.No	Course Code	Course Title	L	T	P	Credits
1	18BSBH05	Probability & Statistics	3	0	0	3
2	18HS0112	Managerial Economics & Financial Analysis	3	0	0	3
3	18PC0305	Kinematics of Machinery	2	1	0	3
4	18PC0306	Air Compressor & IC Engines	2	1	0	3
5	18PC0307	Manufacturing Technology	3	0	0	3
6	18PC0308	Thermal Engineering Lab	0	0	3	1.5
7	18PC0309	Manufacturing Technology Lab	0	0	3	1.5
8	18PS0301	Seminar-I	0	1	0	1
9	18MCBH04	Essence of Indian Traditional knowledge	2	0	0	0
		Total	**15**	**3**	**6**	**19**

DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech V Semester

S.No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	18PC0310	Design of Machine Elements	2	1	0	3
2	18PC0311	Dynamics of Machinery	2	1	0	3
3	18PC0312	Applied Thermal Engineering	3	0	0	3
4	18PC0313	Fluid Mechanics & Hydraulic Machinery	2	1	0	3
5	18PC0314	Machine Tools	3	0	0	3
6	HSMC	**Open Elective-I**	3	0	0	3
	18M00113	Management Science				
	18OE0301	Industrial Engineering				
	18OE0302	Production Design				
7	18PC0315	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	1.5
8	18PC0316	Machine Tools Lab	0	0	3	1.5
9	18BSBH15	Quantitative Aptitude	0	0	2	1
		Total	**15**	**3**	**8**	**22**

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DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech VI Semester

S.No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	18PC0317	Heat Transfer	2	1	0	3
2	18PC0318	CAD/ CAM	3	0	0	3
3	PE	**Professional Core Elective-I**	3	0	0	3
	18PE0301	Design of Transmission Elements				
	18PE0302	Flexible Manufacturing Systems				
	18PE0303	Geometric Modeling				
4	PE	**Professional Core Elective-II**	3	0	0	3
	18PE0304	Automobile Engineering				
	18PE0305	Gas Turbines & Jet Propulsion				
	18PE0306	Metal Forming Process				
5	OE	**Open Elective-II**	3	0	0	3
	18OE0303	Operations Research				
	18OE0304	Total Quality Management				
	18OE0305	Energy Management				
6	OE	**Open Elective-III**	3	0	0	3
	18M00114	Entrepreneurship				
	18PC0503	Data Base Management System				
	18OE0306	Alternative Sources of Energy				
7	18PC0319	Heat Transfer Lab	0	0	3	1.5
8	18PC0320	CAD/CAM Lab	0	0	3	1.5
9	18BSBH16	Logical Reasoning	0	0	2	1
10	18PS0302	Seminar –II	0	1	0	1
		Total	**17**	**2**	**8**	**23**

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DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech VII Semester

S.No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	18PC0321	Metrology & Measurements	3	0	0	3
2	OE	**Open Elective-IV**	3	0	0	3
	18OE0307	Composite Materials				
	18OE0308	Intellectual Property Rights				
	18OE0309	Design of Heat Transfer Equipment				
3	PE	**Professional Core Elective-III**	3	0	0	3
	18PE0307	Automation & Robotics				
	18PE0308	Computational Fluid Dynamics				
	18PE0309	Advanced IC Engines				
4	PE	**Professional Core Elective-IV**	3	0	0	3
	18PE0310	Finite Element Methods				
	18PE0311	Tool Design				
	18PE0312	Refrigeration & Air Conditioning				
5	18PC0322	Metrology & Measurements Lab	0	0	3	1.5
6	18PC0323	CAE Lab	0	0	3	1.5
7	18PS0303	Mini Project /Internship	0	0	2	1
8	18PS0304	Project Work Phase-I	0	0	8	4
		Total	**12**	**0**	**16**	**20**

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DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech VIII Semester

S.No	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	PE	**Professional core Elective-V**	3	0	0	3
	18PE0313	Power Plant Engineering				
	18PE0314	Mechatronic Systems				
	18PE0315	Mechanical Vibrations				
2	PE	**Professional core Elective-VI**	3	0	0	3
	18PE0316	Additive Manufacturing				
	18PE0317	Modern Manufacturing Methods				
	18PE0318	Tribology				
3	OE	**Open Elective-V**	3	0	0	3
	18OE0310	Production & Operation Management				
	18OE0311	Social Values & Ethics				
	18OE0312	Concurrent Engineering				
4	18PS0305	Project Work Phase-II	0	0	18	9
		Total	**9**	**0**	**18**	**18**

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B.Tech - I Semester

L	T	P	C
3	1	0	4

(18BSBH01) MATHEMATICS - I
(Common to all branches)

Course Objectives: To learn

- Types of matrices and their properties.
- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of eigen values and eigenvectors and to reduce the quadratic form to canonical form
- Concept of mean value theorems and their application to the mathematical problems, Finding maxima and minima of function of two and three variables.
- Concept of Sequence and series
- Concept of Fouries series

UNIT-I: Matrices

Matrices: Types of Matrices- Rank of a matrix by Echelon form and Normal form- System of linear equations- Homogeneous and Non-Homogeneous equations - Gauss elimination method- Gauss Seidel Method- Crout's triangularisation method - Solving system of Homogeneous and Non-Homogeneous equations.

UNIT-II: Eigen values and Eigen vectors

Eigen values and Eigen vectors and their properties- Cayley-Hamilton Theorem (without proof)- finding inverse by Cayley-Hamilton Theorem- Diagonalization of a matrix- finding power of a matrix - Quadratic forms: Reduction of Quadratic form to canonical form and their nature .

UNIT-III: Differential Calculus and its applications

Rolle's theorem- Lagrange's Mean value theorem- simple examples of Taylor's and Maclaurin's series –Functions of several variables- Jacobian–maxima and minima functions of two variables - Lagrange's method of multipliers with three variables.

UNIT-IV: Sequences & Series

Convergence of sequence and series- Tests for convergence - Geometric test- P- test- limit comparison test- D' Alember ratio test- Raabe's test- Cauchy's Integral test- Cauchy's root test-

Logarithmic test- Power series - Taylor's series-series for exponential-trigonometric and logarithm functions.

UNIT-V: Fourier Series

Fourier Series: Determination of Fourier coefficients – Fourier series – Even and odd functions – Fourier series in an arbitrary interval – Even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Write the matrix representation of a set of linear equations and to analyses the solution of the system of equations	PO1,PO2,PO3
CO2	Find the Eigen values and Eigen vectors	PO1,PO2
CO3	Reduce the quadratic form to canonical form using orthogonal transformations	PO1,PO2
CO4	Solve the applications on the mean value theorems.	PO1,PO2
CO5	Analyses the nature of sequence and series. • Gain knowledge to tackle engineering problems using the concepts of fourier series	PO1,PO2,PO3

TEXTBOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, 9th Edition, John Wiley & Sons,2006.
3. Calculus and Analytic geometry by G.B. Thomas and R.L. Finney, 9thEdition,Pearson, Reprint, 2002.

REFERENCES:

1. A text book of Engineering Mathematics by N.P.Bali and Manish Goyal, Laxmi Publications, Reprint, 2008.
2. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
3. Engineering mathematics, volume-I&II, E.Rukmangadachari & E.Keshava Reddy Pearson Publishers.
4. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

CO-PO Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	-	-	-	-	--	-	-	-	-
CO2	3	3	-	-	-	-	-	-	--	-	-	-
CO3	3	3	-	-	-	-	-	-	--	-	-	-
CO4	3	3	-	-	-	-	-	-	--	-	-	-
CO5	3	3	3	-	-	-	-	-	--	-	-	-
Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**--**	**-**	**-**	**-**

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B.Tech - I Semester

L	T	P	C
3	0	0	3

(18BSBH10) ENGINEERING PHYSICS
(Common to CIVIL & MECH)

Objectives:

- Will understand the basics of harmonic oscillator
- Will recognize the importance of mechanics of solids
- Will recognize the basics and applications of dielectric, magnetic and nanomaterials

UNIT I: Harmonic Oscillations

Simple Harmonic oscillator and solution of differential equation, damped harmonic solution of differential equation –over damped, critically damped and lightly damped oscillators – Forced oscillations and resonance (qualitative treatment)

UNIT-II: Physical optics and lasers

Interference in thin films by reflection - Newton's rings - Diffraction - Fraunhofer diffraction from a single slit – Diffraction gratings and characteristics of grating spectrum.

Lasers: basic principle, characteristics, spontaneous and stimulated emission, Coherence, Principle and working of Laser, Population inversion, Pumping mechanism, Types of Lasers: Nd: YAG laser, He-Ne laser, Applications of laser.

UNIT III: Mechanics of solids

Elasticity and isotropic materials, stress, strain and Hookes Law –Elastic constants of isotropic solids, Internal energy due to strain –Longitudinal strain, volume strain and shearing strain

UNIT IV : Dielectrics and Magnetic material

Introduction: Dielectric constant- Dipole moment –Various types of polarization – Electronic –ionic and orientional polarization -Clausius-Mossotti equation-Measurement of Dielectric constant – Application of dielectrics

Magnetisation, permeability and susceptibility, Classification of magnetic materials,

UNIT-V: Physics of nano materials

Introduction of nano materials : Zero, one , two dimensional nano structures - surface to volume ratio – Quantum confinement –density of states and dependence of dimensionality – properties of nano materials. Synthesis of nano materials: Top down process: Ball milling – Bottom up process : Sol gel method

Course out comes:

On successful completion of the course, students will be able to		POs related to COs
C114.1	Understand the basics of harmonic oscillator	PO1,PO2
C114.2	The knowledge of fundamentals of Semiconductor physics, Lasers and fibre optics	PO1,PO2
C114.3	Understand the isotropic materials, solids material help the students to prepare new materials for various engineering applications	PO1,PO2,PO 3
C114.4	The course also helps the students to be exposed to the phenomena of exposure on magnetic materials and dielectric materials	PO1,PO2
C114.5	To understand the Nano materials	PO1

TEXT BOOKS:

1. Engineering Physics-K.Thyagarajan,MCGrawHill Education Private Ltd, New Delhi.
2. Halliday and Resnick, Physics - Wiley.
3. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
4An introduction to the Mechanics of solids, 2nd ed. With SI Units-SH Crandall, NC Dahl & TJ Larnder

REFERENCES:

1. Richard Robinett, Quantum Mechanics
2. J. Singh, Semiconductor Optoelectronics: Physics and Technology, Mc Graw-Hill inc. (1995)
3. Mechanics and properties of matter-J.C.Upadhyaya, Himalaya Publishing house.

CO-PO Mapping

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-									
CO2	2	3										
CO3	2	2	2									
CO4	3	2	-									
CO5	3	-	-									
Average	**2.6**	**2.25**	**2**									

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B.Tech - I Semester

L	T	P	C
2	0	4	4

(18ES0301) ENGINEERING GRAPHICS & DESIGN
(Common to CE & MECH)

Course Objectives:

- To gain and understanding of the basics of geometrical constructions of various planes and solids, understanding system of graphical representation of various objects and various views to draft and read the products to be designed and eventually for manufacturing applications.
- To learn about various projections, to understand complete dimensions and details of object.
- Ultimately student must get imaginary skill to put an idea of object, circuit, assembly of parts in black & white, to design a product and to understand the composition, which can be understood universally.

UNIT – I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Dimensioning, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales – Plain & Diagonal.

UNIT- II

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of regular Plane.—Auxiliary Planes.

UNIT – III

Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere

UNIT – IV

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Intersection of Solids: Intersection of – Prism vs Prism- Cylinder Vs Cylinder

UNIT – V

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions

Auto CAD (for Practice only not for External Exam)

Introduction to CAD, Applications, commands, Tool bar, modeling of Simple parts, isometric problems.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	understanding of the basics of geometrical constructions of various planes and solids	PO1,PO2,PO3,PO10
CO2	The knowledge to about various projections understand complete dimensions and details of object.	PO1,PO2,PO3,PO10
CO3	The understand the composition, which can be understood universally.	PO1,PO2,PO3,PO10
CO4	Preparing working drawings to communicate the ideas and information.	PO1,PO2,PO3,PO10
CO5	Read, understand and interpret engineering drawings.	PO1,PO2,PO3,PO10

TEXTBOOKS:

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai
3. Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

REFERENCE BOOKS:

1. Engineering Drawing / BasantAgrawal and McAgrawal/ McGraw Hill
2. Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson.
3. A text Book of Engineering Drawing and Graphic, K.Venugopal New Age Publishin New Delhi, 2008.
4. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	1	-	-
CO2	3	3	3	-	-	-	-	-	-	1	-	-
CO3	3	3	3	-	-	-	-	-	-	1	-	-
CO4	3	3	3	-	-	-	-	-	-	2	-	-
CO5	3	3	3	-	-	-	-	-	-	2	-	-
Average	**3**	**2.8**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**1.4**	**-**	**-**

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B.Tech - I Semester

L	T	P	C
3	0	0	3

(18HSBH01) TECHNICAL ENGLISH
(Common to CE, EEE, MECH & ECE)

Course Objectives:

- To enable the students to communicate in English for academic and social purpose
- To enable the students to acquire structures and written expressions required for the profession
- To enhance the study skills of the students with emphasis on LSRW skills
- To encourage investigating questions of the humanities throw rhetorical study
- To develop and practice and evaluative reading

UNIT – I

Chapter entitled " MEDIA MATTERS" from Mindscapes English for Technologists and Engineers

L - Techniques – Importance of Phonetics and Correct Pronunciation
S - Meet & Greet and Leave taking, Introducing Oneself and others (Formal and Informal situations)
R - Reading strategies - Skimming and Scanning
W - Writing strategies – Sentence structures
G - Parts of Speech – Noun -number, Pronoun- Personal Pronoun – Verb –analysis
V - Affixes – Prefix and Suffix – Root words, derivatives

UNIT – II

Chapter entitled "LESSONS FROM THE PAST" from Mindscapes English for Technologists and Engineers

L - Listening to details: Types of Listening 1. Discriminative listening 2. Comprehension listening 3. Critical listening 4. Appreciative listening
S - Requesting, Making Polite Conversations and Role Play
R - Note Taking and Note Making Strategies
W - Paragraph Writing and Good qualities of Paragraph
G - Tenses – Present Tense, Past Tense and Future Tense
V - Homonyms, Homophones, Homographs, Synonyms and Antonyms

UNIT – III

Chapter entitled "TRAVEL AND TOURISM" from Mindscapes English for Technologists and Engineers

L - Listening to Speeches of Great leaders and Scientists
S - Accepting Invitations, Fixing a Time and Advising
R - Reading Tables, and Charts
W - Conversation, Role Play and autobiography

G - Types of Sentences (Simple, Complex and Compound)
V - Word formations and One –Word Substitutes

UNIT – IV
Chapter entitled "THE LOST LEAF" from American stories by O. Henry

L - Listening Dialogues and News
S - Expressing Ideas, Opinions and Telephone Skills
R - Reading Short Stories
W - Biography and Reporting Writing
G - Conditional Clauses and Voices
V - Fixed Expressions and Idioms

UNIT – V
Chapter entitled "SUNITA WILLIAMS" A Star in Space: Puffin Lives Kindle Edition by Aravinda Anatharaman

L - Types of Listening Speeches: Informative, Demonstrative, Persuasive , Entertaining
S - Making Presentations (Mime and Guess, Mono action, Autobiography and Biography)
R - Reading for Entertainment (Humorous short skits)
W – Resume, CV and Cover letter
G - Direct Speech & Indirect Speech
V - Phrasal Verbs and Collocations

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Student can responding to a variety of situations and contexts calling for purposeful shifts in the voice, tone level of formality, design, medium and structure	PO1,PO10
CO2	Become effective in the use of different modes of written communication in professional environment	PO1,PO10,PO12
CO3	Well trained in LSRW skills and develop communicate competence	PO1,PO9
CO4	Use key rhetorical concepts through analyzing and composing a variety of text	PO1,PO12
CO5	Develop competence to apply different reading methods to evaluate a mass of data on the net and to glean the necessary information	PO1,PO6

Text Book:
1. Mindscapes English for Technologists and Engineers Published by Orient Black Swan
2. American stories by O. Henry
3. A Star in Space: Puffin Lives Kindle Edition by Aravinda Anatharaman

References:
1. A. Textbook of English Phonetics for Indian Students by T. Balasubramanian, 2012
2. Communication Skills, Sanjay Kumar & Pushpalatha Oxford University Press
3. Every Day Dialogues in English – Robert J. Dixson, Prentice Hall of India
4. Raymond Murphy's English Grammar with CD, Murphy, Cambridge University Press, 2012

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	2	-	2
CO3	3	-	-	-	-	-	-	-	3	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	3	-	-	-	-	-	-
Average	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**2.5**	**-**	**2.5**

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B.Tech - I Semester

L	T	P	C
0	0	3	1.5

(18BSBH11) PHYSICS LAB
(Common to CE, EEE, MECH & ECE)

Course Description:

It is meant for making the students to gain practical knowledge and skills to correlate with the theoretical studies.

Course Objectives:

- Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.
- Illustrate the basics of mechanics, waves and optics to analyze the behaviour and characteristics of various materials for its optimum utilization.
- Develop an ability to apply the knowledge of physics experiments in the future studies.

List of Experiments: (Any eight experiments to be performed in a semester)

1. Determination of radius of curvature - Newton's Rings
2. Magnetic field along the axis of a current carrying coil - Stewart Gees' Apparatus
3. Determination of Energy gap of a material of p-n junction.
4. Dispersive power of prism – Spectrometer
5. Wavelength of a given laser source- Diffraction Grating
6. Optical fibre: Numerical Aperture and acceptance angle of an optical fibre
7. Diffraction grating: normal incidence method
8. Particle size determination -Laser
9. Study of B-H curve
10. Study of resonance – series and parallel LCR circuits

COURSE OUTCOMES	
CO1	Recognize the important radius of curvature - Newton's Rings (PO1, PO2) . (PO1, PO2,PO3)
CO2	Acquired the practical application knowledge of optical fiber, resonance – series and parallel LCR circuits (PO1, PO2, PO3)
CO3	Analyze the practical applications of dielectric and magnetic materials and crystal structure in various engineering feels. (PO1, PO2)
CO4	Understand of practical laser by the study of their relative parameters. (PO1, PO2)
CO5	Recognize power of prism – Spectrometer, material of p-n junction in various engineering tools (PO1,PO2,PO4)

CO6	Follow the ethical principles in implementing the experiments (PO8)
CO7	Do experiments effectively as an individual and as a team member in a group. (PO9)
CO8	Communicate verbally and in written form, the understanding about the experiments. (PO10)
CO9	Continue updating their skill related to optical fiber, p-n junction, laser and LCR circuits in implementing experiments in future. (PO12)

Reference books:

1. Engineering Physics practical-NU Age Publishing House, Hyderabad
2. Engineering practical Physics – Cengage Learning, Delhi.

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2										
CO2	2	3	3									
CO3	2	3										
CO4	3	2										
CO5	3	2		3								
CO6								3				
CO7									2			
CO8										3		
CO9												3
averag	**2.6**	**2.4**	**3**	**3**	**-**	**-**	**-**	**3**	**2**	**3**	**-**	**3**

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B.Tech - I Semester

L	T	P	C
0	0	3	1.5

(18HSBH02) ENGLISH LANGUAGE COMMUNICATION SKILS LAB
(Common to CE, EEE, MECH & ECE)

The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts

Objectives:

- To enable students to learn good pronunciation through stress on word accent, intonation and rhythm.
- To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence.
- To train students to use language appropriately for interviews, group discussion and public speaking.
- To enable students to read with correct pronunciation and Vocabulary development in day today life.

Outcomes:

- Become active participants in the learning process and acquire proficiency in spoken English. Speak with clarity and confidence thereby enhances employability skills.
- Second language learners can acquire fluency in spoken English and neutralize their mother tongue influence.
- Students can use language appropriately for interviews, Group discussions and Public speaking.
- Students can read with correct pronunciation and Develop Vocabulary.

UNIT – I

LISTENING AND READING - PART

A. Reading – Vocabulary Development.

B. Listening – Speeches / Conversation/ Biographies.

UNIT – II

LISTENING AND READING - PART

A. Phonetics – Importance, Introduction to Sounds of English, Vowel and Consonants Sounds and Phonetic Transcription.

B. Word Stress, Syllabification, Rules of Word Stress, Intonation and Types of Intonations.

UNIT – III

WRITING - PART

A. Reports Writing and Types of Reports.

B. Resume/ CV and Cover Letter.

UNIT – IV

SPEAKING - PART

A. Self Introduction, Introducing the others, JAM and Role Play.

B. Describing objects/things/ places and people.

UNIT – V

PARTCIPATING - PART

A. Debate and Group Discussions.

B. Interview Skills (Basic types of Interviews, Do's & Don'ts in Interviews).

COURSE OUTCOMES	
CO1	Understand the active participants in the learning process and acquire proficiency in spoken English. (PO1, PO8 PO10)
CO2	Develop the Speak with clarity and confidence thereby enhances employability skills. (PO1, PO8, PO10)
CO3	Second language learners can acquire fluency in spoken English and neutralize their mother tongue influence (PO8, PO9, PO10)
CO4	Develop language appropriately for interviews, Group discussions and Public speaking (PO8 PO9 PO10)
CO5	Understand the read with correct pronunciation and Develop Vocabulary.. (PO8, PO10, PO12)
CO6	Follow the ethical principles in implementing the speaking skills. (PO8)
CO7	Do discus effectively as an individual and as a team member in a group. (PO9)
CO8	Communicate verbally and in written form, the understanding about the language. (PO10)
CO9	Continue updating their skill related to pronunciation, vocabulary, intervies implementing skills in future. (PO12)

Suggested Software:

1. Clarity Pronunciation Power - Part I - Part II (Sky Pronunciation).
2. Walden Info Tech Software.

References:

1. A Course in Phonetics and Spoken English, Dhamija Sethi, Prentice –Hall of India Pvt.Ltd.
2. Speaking English Effectively, 2nd Edition Krishnn Mohan & NP Singh, 2011. (Macmillian).
3. A Hand book for English Laboratories, E.Suresh Kumar, P. Sreehari, Foundation Books, 2011.

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1								3		2				
CO2								3		3				
CO3								2	3	3				
CO4								3	2	2				
CO5								2		3		3		
CO6								3						
CO7									2					
CO8										3				
CO9												3		
Average	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.5**	**2.3**	**2.6**	**-**	**3**	**2**	**2**

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B.Tech - I Semester

L	T	P	C
0	0	3	1.5

(18ES0302) ENGINEERING & IT WORKSHOP PRACTICE
(Common to all Branches)

Part-A Engineering Workshop Lab

Course Objectives:

- To Study of different hand operated tools, uses and their applications
- To Know a basic working knowledge, team work, precision and safety on production of various engineering products.
- To Provide a hands on experience of different engineering materials, tools, equipments and processes those are commonly used in the engineering fields.

Course Outcomes:

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

- Study and practice on machine tools and their operations
- Practice on manufacture of components in different workshop trades.
- Identify and apply suitable tools for different trades of Engineering processes
- Apply basic electrical engineering knowledge for house wiring practice.

1. TRADES FOR EXERCISES:

At least TWO exercises from each trade:

I.	Carpentry	: T-Lap Joint, Dovetail Joint, Mortise &Tenon Joint
II.	Tin-Smithy	: Square Tin, Rectangular Tray & Conical Funnel

At least ONE exercises from each trade:

III.	Fitting	: V-Fit, Dovetail Fit & Semi-circular fit
IV.	Foundry	:Preparation of Green Sand Mould using Single Piece and Split Pattern
V.	Welding practice	: Arc Welding & Gas Welding
VI.	House-wiring	: Parallel & Series, Two-way Switch and Tube Light
VII.	Black Smithy	: Round to Square, Fan Hook and S-Hook

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Tools in construction work and Wood Working.

NOTE: At least the total number of exercises must be SEVEN.

TEXT BOOKS:

1. Workshop Practice /B. L. Juneja / Cengage

2. Workshop Manual / K. Venugopal / Anuradha.

REFERENCE BOOKS:

1. Work shop Manual - P. Kannaiah/ K. L. Narayana/ SciTech

2. Workshop Manual / Venkat Reddy/ BSP

Part-B IT Workshop Lab

Course Objective:

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

Learning Outcome:

- disassemble and assemble a Personal Computer and prepare the computer ready to use.
- Prepare the Documents using Word processors
- Prepare Slide presentations using the presentation tool
- Interconnect two or more computers for information sharing
- Access the Internet and Browse it to obtain the required information
- Install single or dual operating systems on computer

Preparing your Computer

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals.
Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: Networking and Internet Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc should be done by the student. The entire process has to be documented.

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

Productivity tools

Task 5: Word Processor: Students should be able to create documents using the word Processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, Changing the font, changing the color, including images and tables in the word file, Making page setup, copy and paste block of text, images, tables, linking the images Which are present in other directory, formatting paragraphs, spell checking, etc. Studentsshould be able to prepare project cover pages, content sheet and chapter pages atthe end of the task using the features studied. Students should submit a user manual of the word processor considered.

Task 6: Spreadsheet: Students should be able to create, open, save the application Documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and Deleting cell data, format cells, adjust the cell size, applying formulas and functions, Preparing charts,+ sorting cells. Students should submit a user manual of the Spreadsheet Application considered.

Task 7: Presentations:creating, opening, saving and running the presentations, Selectingthe style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyper linking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

Task 8: Latex introduction, Document Structure, Typesetting Text, table of contents packages, math, adding pictures

Task 9: Laboratory Equipment: Students may submit a report on specifications of various equipment that may be used by them for the laboratories in their curriculum starting from I B.Tech to IV. B.Tech. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

_ Desktop computer
_ Server computer
_ Switch (computer science related)

COURSE OUTCOMES	
CO1	Understand the mechanical tools and there operations and practice on manufacture of components in different work shop trades. (PO1, PO2, PO4)
CO2	Acquire suitable tools for different trades of engineering processes. (PO1, PO5, PO9)
CO3	Recognize the dissemble and assemble a personal computer and prepare the computer ready to use. (PO1, PO3, PO12)
CO4	Develop the documents using word processors and slides preparations using presentation tools (PO1, PO10, PO12)
CO5	Access the internet and browse it be obtain the required information and install single or dual operating system and computer. (PO1, PO3, PO12).
CO6	Follow the ethical principles in implementing the engineering materials and presentation tools. (PO8)
CO7	Do practice effectively as an individual and as a team member in a group. (PO9)
CO8	Communicate verbally and in written form, the understanding about the engineering tools. (PO10)
CO9	Continue updating their skill related to trades for exercises, demonstration, productivity tools, networking and internet implementing skills in future. (PO12)

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3		2								
CO2	3				2				2			
CO3	2		3									3
CO4	2									2		2
CO5	3		2									3
CO6								3				
CO7									2			
CO8										3		
CO9												3
AVEG	**2.4**	**3**	**2.5**	**2**	2	-	-	3	2	**2.5**	-	**2.7**

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B.Tech - II Semester

L	T	P	C
2	1	0	3

(18BSBH02) MATHEMATICS-II
(Common to all branches)

Course Objectives:

- Methods of solving the differential equations of first and higher order.
- Evaluation of method of integration and it's applications.
- The physical quantities involved in engineering field related to vector valued functions.
- The basic properties of vector valued functions and their applications to line Surface and volume integrals.
- To understand Z-Transforms and its applications.

UNIT – I: First Order O.D.E

Exact - linear and Bernoulli's equations - Applications to Newton's law of cooling-Orthogonal trajectories. Equations of first order but not of first degree - equations solvable for p- equations solvable for y-equations solvable for x and Clairaut's type.

UNIT –II: Ordinary Differential Equations of higher order

Homogeneous and Non homogeneous linear differential equations of second and higher order with constant coefficients with RHS terms of type e^{ax} - sin ax- cos ax- polynomials in x- e^{ax} v(x) - xv(x).

UNIT –III: Multiple integrals

Multiple integral- double and triple integrals- change of order of integration. Applications to areas and volumes in Cartesian and polar coordinates using double and triple integral.

UNIT –IV: Vector Calculus

Introduction-Vector differentiations-Vector differential operator- Gradient – Divergence-Curl and their properties - Vector integration - Line integral-Potential function – Area - Surface and volume integrals- Vector integrals theorems: Green's theorem - Stoke's and Gauss's Divergence theorem (without proof).

UNIT –V: Z-TRANSFORMS

Z-Transform - Inverse Z-transform- properties-Damping Rule – Shifting rule-Initial and Final value theorem - Convolution theorem –Introdution to difference equations -Solutions of difference equations by Z-transforms.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Identify whether the given differential equation of first order is exact or not.	PO1,PO2
CO2	Solve higher differential equation and apply the concept of	PO1,PO2

	differential equation to real world problems.	
CO3	Evaluate the multiple integrals and apply the concept of find areas, volumes, centre of mass and Gravity for cubes, sphere and rectangular parallelepiped.	PO1,PO2
CO4	Evaluate the line, surface and volume integrals and converting them from one to another.	PO1,PO2
CO5	Gain knowledge to tackle engineering problems using the concepts of Z-Transforms	PO1,PO2,PO3

Text Books:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Engineering Mathematics Volume-I &II by T.K.V. Iyengar, S.Chand publication.

Reference Books:

1. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
2. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. Engineering Mathematics, volume-I&II, E. Rukmangadachari& E.Keshava Reddy Pearson Publishers.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	--	--	--	--	--	--	--	--	--
CO5	3	3	3	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-

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B.Tech - II Semester

L	T	P	C
3	0	0	3

(18BSBH12) ENGINEERING CHEMISTRY
(ECE, EEE, CIVIL & MECH)

Course Objectives:

- To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
- To provide the information regarding hardness of water, effects of hard water in boilers and treatment methods to avoid bad effect on human health. To check the parameters of various water samples by experimental techniques.
- To impart the knowledge of stereochemistry and synthetic aspects useful for understanding reaction pathways.
- To make students familiar with importance of electrochemical processes in nature and industry, like coating of objects with metals or metal oxides through electro deposition.
- To acquire the skills pertaining to spectroscopy and to apply them for medical and other fields.

UNIT – I: WATER QULAITY AND ITS TREATMENT

INTRODUCTION: Introduction – hardness of water – Causes of hardness - Types of hardness: temporary and permanent – expression and units of hardness –Numerical problems on estimation of hardness.

CHEMICAL ANALYSIS OF WATER: Estimation of hardness of water by EDTA method, acidity, alkalinity and dissolved oxygen (BOD & COD).

BOILER TROUBLES: scales and sludges, caustic embrittlement, boiler corrosion and priming and foaming.

SOFTENING OF WATER: Internal Conditioning - Phosphate Conditioning, Calgon Conditioning; **External Treatment** - Zeolite process and Ion-exchange process, advantages and applications.

WATER FOR MUNICIPAL TREATMENT: Disinfection, Chlorination – Breakpoint Chlorination**,** Ozonization, UV Treatment – Reverse Osmosis: Desalination of Brakish water by Electrodialysis.

UNIT – II: MOLECULAR STRUCTURE & THEORIES OF BONDING:

Atomic and Molecular orbitals, Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N_2, O_2 and H_2^+ molecules. π molecular orbitals of 1,3 butadiene, CO and benzene.

CRYSTAL FIELD THEORY (CFT): Salient Features of CFT – Crystal Field Splitting of transition metal ion d- orbitals in Tetrahedral, Octahedral and square planar geometries (One Specific Example for Each)

UNIT – III: ELECTRO CHEMISTRY AND CORROSION

Electrochemistry and corrosion: Electro chemical cells – electrode potential, standard electrode potential, types of electrodes – calomel, Quinhydrone and glass electrode. Nernst equation, Electrochemical series and its applications. Conductometric titrations. Batteries – Primary (Lithium cell) and secondary batteries (Lead – Acid Batter and Lithium ion Batteries).

FUEL CELLS: H_2-O_2 fuel cell, Solid oxide fuel cell, PEM fuel cell – Principles, advantages and applications.

SCIENCE OF CORROSION: Definition, Types of Corrosion – Examples: Mechanism of Dry and Wet Corrosion, Factors influencing corrosion

Corrosion control- Cathodic protection – Sacrificial anodic and impressed current cathodic protection methods - Electroplating of (Cu & Cr) and Electro less Plating

UNIT-IV: STEREOCHEMISTRY, REACTION MECHANISM & SYNTHESIS OF DRUG MOLECULES:

STEREO CHEMISTRY: Introduction to representation of 3-dimensional structures, Structural isomers and stereoisomers, symmetry and chirality. Enantiomers, diastereomers, optical activity and Absolute configuration.

REACTION MECHANISM: Substitution reactions: Nucleophilic substitution reactions: Mechanism of SN^1, SN^2 reactions. Electrophilic and nucleophilic addition reactions: Markownikoff and anti Markownikoff's additions. Elimination reactions: Dehydro halogenation of alkylhalides. Oxidation reactions: Oxidation of alcohols using $KMnO_4$. Reduction reactions: reduction of carbonyl compounds using $NaBH_4$.

SYNTHESIS OF DRUG MOLECULES: Structure, synthesis and pharmaceutical applications of Aspirin.

UNIT – V: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS:

Introduction – Basic principles of UV-Vis, FT-IR, ^{1}HNMR, XRD –One Specific application for each Technique.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	The understanding the problem of water and its treatments.	PO1,PO2,PO3
CO2	The knowledge of atomic, molecular and electronic changes, band theory related to conductivity.	PO1,PO2,PO3
CO3	The required principles and concepts of electrochemistry, corrosion	PO1,PO2,PO3,PO7
CO4	The knowledge of configurational and conformational analysis of molecules and reaction mechanisms.	PO1,PO2
CO5	The required skills to get clear concepts on basic spectroscopy and application to	PO1,PO2

SUGGESTED TEXT BOOKS:

1. Engineering Chemistry by P.C.Jain & M.Jain; Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Fundamentals of Molecular Spectroscopy, by C.N. Banwell.
3. Organic Chemistry: Structure and Function by K.P.C. Volhardt and N.E.Schore, 5th Edition.
4. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
5. Physical Chemistry, by P. W. Atkins
6. Inorganic Chemistry by J.D.LEE.

REFERENCES

1. Engineering Chemistry (NPTEL Web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan
2. University Chemistry, by B.M. Mahan, Pearson IV Edition

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	3	2	3	-	-	-		-	-	-	-	-
CO3	3	3	2	--	--	--	3	-	--	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	--	-	-	-	-
Average	**3**	**2.2**	**2**	**-**	**-**	**-**	**3**		**-**	**-**	**-**	**-**

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B.Tech - II Semester

L	T	P	C
3	1	0	4

(18ES0501) PROBLEM SOLVING USING 'C'
(Common to EEE, ECE & CSE)

COURSE OBJECTIVES:

- To Understand the Hardware of the computer and the General form of a C program.
- To Understand the Decision Making and Loop statements of C Language.
- To Understand the Arrays and String concept of C Language.
- To understand the concept of Functions and Pointers in C Language.
- To Understand about Structures, Unions and Files in C Language.

UNIT-I

Overview of Computers and Programming: Electronic Computers Then and Now, Computer Hardware, Computer Software, Computer Languages, Algorithm, Steps in an Algorithm, Flowchart, The Software Development Method, Applying The Software Development Method.

Introduction to C Programming: C Language Elements, Variable Declarations, Data Types, Executable Statements, General Form of a C program, Expressions, Precedence and Associativity, Operators, Type Conversion.

UNIT-II

Decision Making Statements- Simple **if** Statement, **if-else** Statement, Nested **if-else** Statement**, if-else-if** Ladder Statement**,** Example Programs.

Loop Control Statements- The "for" loop, the "while" loop, the "do-while" loop, Example Programs, **Break** Statement, **Continue** Statement, **go to** Statement, **Switch ()- Case** Statement

UNIT-III

Arrays- Definition, One-Dimensional Arrays- Declaration, Initialization, "for" loop for Sequential access, Example Programs. Two-Dimensional Arrays: Declaration, Initialization, Example Programs.

Strings- Introduction, Declaration and Initialization of String Variables, Reading Strings from Terminal, Writing Strings to screen, Arithmetic Operators on Characters, Putting Strings Together, Comparison of Two Strings, String Handling Functions, Table of Strings.

UNIT-IV

Functions- Elements of User-Defined Functions, Definition of Functions, category of Functions, Nested Functions, Recursion, Passing Arrays to Functions, Scope, Storage Classes, Type Qualifiers.

Pointers- Introduction, Understanding Pointers, Accessing the Address of a Variable, Declaring Pointer Variable, Initialization of Pointer Variables, Accessing a Variable through its Pointer, Chain of Pointers, Pointer Expression, Pointer Increments and Scale Factor, Pointers and Arrays, Array of Pointers, Pointers as Function Arguments.

UNIT-V

Structures- Defining a Structure, Declaring Structure Variables, Accessing Structure Members, Structure Initialization, Copying and Comparing Structure Variables, Operations on Individual Members, Arrays of Structures, Arrays within Structures, Unions, TYPEDEF, ENUM.

File Management in C- Introduction, Types of Files, Defining and Opening a File, Closing a File, Input/output Operation on Files, Error handling during I/O Operations, Random Access to Files, Command Line Arguments.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Able to describe the Hardware components of a computer	PO1,PO2
CO2	Able to implement the 'if...else' statements and 'for', 'while', 'do…while' loop statements	PO1,PO2,PO3
CO3	Able to write programs using Arrays and Strings concept.	PO1,PO2
CO4	Able to implement Function and Pointer concepts on various applications.	PO1,PO2,PO4
CO5	Able implement File concepts of C Language.	PO1,PO2

Text Books

1. Programming In "C" and Data Structures- By Jeri. R. Hanly, Elliot. B. Koffman, Ashok Kamthane, A. Ananda Rao, 5th Edition, Pearson Publication. (Units I and II).
2. Programming In "C" and Data Structures- By E. Balagurusamy, McGraw Hill Publication (Units III, IV and V).

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	--	-	-	-	-	-	-
CO2	3	2	3	-	-	--	-	-	-	-	-	-
CO3	3	3	-	-	-	--	-	-	-	-	-	-
CO4	3	3	-	3	-	--	-	-	-	-	-	-
CO5	2	3	-	-	-	--	-	-	-	-	-	-
Average	**2.8**	**2.8**	**3**	**3**	**-**	**--**	**-**	**-**	**-**	**-**	**-**	**-**

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B.Tech - II Semester

L	T	P	C
3	0	0	3

(18ES0206) BASIC ELECTRICAL ENGINEERING
(Common to MECH & CSE)

Course objective*:*

To help students develop an understanding on analyzing electrical circuits using various techniques. To make the student familiarize with the fundamental concepts of circuits, resonance, two port network and to analyze the response in electric circuits.

UNIT I DC Circuits:
Voltage-Current-Ohm's Law, Kirchoff Voltage and Kirchoff Current Law-Series and Parallel Resistors -Voltage Division and Current Division-Star to Delta and Delta to Star Transformation-Basic Nodal and Mesh Analysis-Source Transformation. Network Theorems- Superposition, Thevenin's, Norton's, Maximum Power Transfer Theorem.

UNIT II AC Circuits
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (seriesand parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections

UNIT III Transformers:
Principle, Construction and operation of single-phase transformers, EMF equation, equivalent circuit, Phasor diagram, voltage regulation, Losses and efficiency Testing - Autotransformers - principle, applications, Three-phase transformer connections

UNIT IV Electrical Machines - I
Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT V Electrical Machines - II
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor.

Course outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	The help students develop an understanding on analyzing electrical circuits using various techniques.	PO1,PO2,PO3 PO5,PO12
CO2	The student familiarize with the fundamental concepts of circuits, resonance, two port network and to analyze the response in electric circuits.	PO1,PO2,PO3 PO5,PO12
CO3	Given a network, find the equivalent impedance by using network reduction techniques	PO1,PO2,PO3 PO5,PO12
CO4	Determine the current through any element and voltage across any element	PO1,PO2,PO3 PO5,PO12
CO5	Apply the network theorems suitably	PO1,PO2,PO3 PO5,PO12

Text-Books:

1) Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.

2) Basic Electrical Engineering - D.C. Kulshreshtha, 2009, Tata McGraw Hill.

References:

1) Fundamentals of Electrical Engineering, L.S. Bobrow, Oxford University Press, 2011

2) Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010

3) Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India,

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2		2							3
CO2	3	2	2		2							3
CO3	3	3	2		2							3
CO4	3	3	1		1							3
CO5	2	2	1		1							2
Average	**2.8**	**2.6**	**1.6**		**1.6**							**2.8**

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B.Tech - II Semester

L	T	P	C
3	0	0	3

(18ES0101) ENGINEERING MECHANICS

Objective:

The objective of this Course is to provide an introductory treatment of Engineering Mechanics to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters. A working knowledge of statics with emphasis on force equilibrium and free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions. Lab should be taken concurrently

UNIT – I

INTRODUCTION OF ENGINEERING MECHANICS – Basic concepts - System of Forces – Moment of Forces and its Application – Couples and Resultant of Force System – Equilibrium of System of Forces - Degrees of Freedom – Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT – II

FRICTION : Types of friction– laws of Friction – Limiting friction- Cone of limiting friction– static and Dynamic Frictions – Motion of bodies – Wedge, Ladder friction. Applications-Screw jack.

UNIT – III

PROPERTIES OF SECTIONS & CENTROID AND CENTER OF GRAVITY: Centroid of simple figures – Centroid of Composite figures – Centre of Gravity of bodies – Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures. Radius of gyration - Section modulus.

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

UNIT – IV

KINEMATICS: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of A Rigid Body – Types and their Analysis in Planar Motion.

KINETICS OF PARTICLE & RIGID BODIES: Analysis in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies – Work Energy Method. Newton's law of motion, D-Alembert principle, Work energy method. Impulse - momentum equation.

UNIT – V

ANALYSIS OF PERFECT FRAMES: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, method of sections for vertical loads, horizontal loads and inclined loads.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	The help students develop an understanding on equilibrium equation, moments and inertia problems	PO1,PO2,PO3, PO5,PO12
CO2	Mater calculator/computing basic skills to use to advantage in solving mechanics problems.	PO1,PO2,PO3, PO5,PO12
CO3	Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering	PO1,PO2,PO3, PO5,PO12
CO4	Analysis the translation-central forces of motion, newton's law	PO1,PO2,PO3, PO5,PO12
CO5	Analysis of perfect frames	PO1,PO2,PO3, PO5,PO12

TEXT BOOKS:

1. Engineering Mechanics by Bhavakatti, New age pubilishers
2. Engineering Mechanics by Shames & Rao – Pearson Education.

REFERENCES:

1. Engineering Mechanics by Seshigiri Rao, Universities Press, Hyderabad.
2. Engineering Mechanics – B. Bhattacharyya, Oxford University Publications.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2		2							3
CO2	3	2	2		2							3
CO3	3	3	2		2							3
CO4	3	3	1		1							3
CO5	2	2	1		1							2
Average	**2.8**	**2.6**	**1.6**		**1.6**							**2.8**

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B.Tech - II Semester

L	T	P	C
0	0	3	1.5

(18BSBH13) ENGINEERING CHEMISTRY LAB
(ECE, EEE, CIVIL & MECH)

Course Objectives: The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The student will learn:

- The hygiene aspects of water would be in a position to design methods to produce potable water using modern technology.
- The preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications.
- Will able to understand the knowledge to the processes of corrosion and its prevention.

List of Experiments:

Choice of 10 experiments from the following:

1. Estimation of hardness of water by complexometric method using EDTA.
2. Determination of Alkalinity of water.
3. pH Metry- Analysis of acidic and Basic water samples.
4. Estimation of Dissolved oxygen in water.
5. Preparation of standard $KMnO_4$ solution & Estimation of Iron by Potentiometry.
6. Determination of strength of given strong acid and strong base solution by conductometric titration.
7. Determination of Viscosity of oil through Ostwald/Redwood Viscometer – I.
8. Synthesis of Aspirin.
9. Estimation of Manganese in Cement by Colorimetry.
10. Determination of rate constant of acid catalysed hydrolysis of Methyl acetate.
11. Determination of Surface tension of a give liquid using Stalagmometer.

COURSE OUTCOMES	
CO1	Acquired the practical skill to handle the analytical methods with confidence.(PO1,PO2,PO3)
CO2	The desirable limits of various constituents in water analysis and its importance. (PO1, PO2)
CO3	Understand of practical molecular properties such as viscosity, conductance of solutions, etc (PO1, PO2, PO3)
CO4	Analyze the rate constant of a reaction from concentration – time relationships.(PO1,PO2,PO4)
CO5	Analyze the preparations, properties of Aspirin in modern technology. (PO1, PO2, PO3).
CO6	Follow the ethical principles in implementing the experiments (PO8)
CO7	Do experiments effectively as an individual and as a team member in a group. (PO9)

CO8	Communicate verbally and in written form, the understanding about the experiments. (PO10)
CO9	Continue updating their skill related to analytical methods, viscosity, rate constant in implementing experiments in future. (PO12)

REFERENCE BOOKS:

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et al, Pearson Education, Sixth Edition, 2012.
2. Senior practical physical chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co.,Delhi).
3. An introduction to practical chemistry, K.K. Sharma and D. S. Sharma (Vikas publishing, N. Delhi).

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2											
CO2	3	2												
CO3	2	3	2											
CO4	3	2		2										
CO5	2	2	3											
CO6								3						
CO7									2					
CO8										3				
CO9												3		
average	**2.6**	**2.4**	**2.3**	**2**	**-**	**-**	**-**	**3**	**2**	**3**	**-**	**3**	**2**	**2**

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B.Tech - II Semester

L	T	P	C
0	0	3	1.5

(18ES0502) PROBLEM SOLVING USING 'C' LAB
(Common to CIVIL & MECH)

List of Experiments/Tasks

1. Practice programs: Finding the sum of three numbers, exchange of two numbers, maximum of two numbers, to read and print variable values of all data types of C language, to find the size of all data types, to understand the priority and associativity of operators using expressions, to use different library functions of C language.
2. Write a program to find the roots of a Quadratic equation.
3. Write a program to compute the factorial of a given number.
4. Write a program to check whether the number is prime or not.
5. Write a program to find the series of prime numbers in the given range.
6. Write a program to generate Fibonacci numbers in the given range.
7. Write a program to find the maximum and minimum of a set of numbers.
8. Write a program to reverse the digits of a number.
9. Write a program to find the sum of the digits of a number.
10. Write a program to find the sum of positive and negative numbers in a given set of numbers.
11. Write a program to check for number palindrome.
12. Write a program to generate Pascal Triangle.
13. Write a program to read two matrices and print their sum and product in the matrix form.
14. Write a program to read matrix and perform the following operations.
    i. Find the sum of Diagonal Elements of a matrix.
    ii. Print Transpose of a matrix.
    iii. Print sum of even and odd numbers in a given matrix.
15. Write a program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters.
16. Write a program to insert a substring in to a given string and delete few characters from the string. Don't use library functions related to strings.
17. Write a program to split a „file" in to two files, say file1 and file2. Read lines into the file from standard input. File1 should consist of odd numbered lines and file2 should consist of even numbered lines.
18. Write a program to merge two files.
19. Write a program to read a set of strings and sort them in alphabetical order.
20. Write a program to read two strings and perform the following operations without using Built in string Library functions and by using your own implementations of functions.
    i. String length determination ii .Compare Two Strings

ii. Concatenate them, if they are not equal iv. String reversing

21. Write programs using recursion for finding Factorial of a number, GCD, LCM, and solving Towers of Hanoi problem.
22. Write a program to exchange two numbers using pointers.
23. Write a program to read student records into a file. Record consists of roll no, name and Marks of a student in six subjects and class. Class field is empty initially. Compute the class of a student. The calculation of the class is as per JNTUA rules. Write the first class, second class, third class and failed students lists separately to another file.
24. A file consists of information about employee salary with fields employee id, name, Basic, HRA, DA, IT, other-deductions, Gross and Net salary. Initially only employee id, name, and basic have valid values. HRA is taken as 10% of the basic, DA is taken as 80% of basic, IT is 20% of the basic, other deductions are user specified. Compute the Gross and Net salary of the employee and update the file.
25. Write a program to perform Base (decimal, octal, hexadecimal,…) conversions.
26. Write a program to find the square root of a number without using built-in library function.
27. Write C program to convert a string to number.
28. Write C program to generate multiplication tables from 11 to 20.

COURSE OUTCOMES	
CO1	Design the algorithm and flowchart for the given problem. (PO1, PO2,PO3)
CO2	Develop the programs on control statements and arrays. (PO1, PO2, PO3)
CO3	Analyze the concepts on functions and strings. (PO1, PO2)
CO4	Solve the memory access problems by using pointers and design the programs on structures and unions. (PO1, PO2, PO4)
CO5	Analyze the basics of file handling mechanism that is essential for understanding the concepts of management systems. (PO1, PO2)
CO6	Follow the ethical principles in implementing the programs (PO8)
CO7	Do experiments effectively as an individual and as a team member in a group. (PO9)
CO8	Communicate verbally and in written form, the understanding about the experiments. (PO10)
CO9	Continue updating their skill related to loops, pointers and files implementing programs in future. (PO12)

References:

1. “How to Solve it by Computer”, R.G. Dromey, Pearson.
2. “The C Programming Language”, Brian W. Kernighan, Dennis M. Ritchie, Pearson.
3. “Let us C”, YeswantKanetkar, BPB publications
4. “Pointers in C”, YeswantKanetkar, BPB publications.
5. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.AnandaRao,Pearson Education.

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2											
CO2	3	3	3											
CO3	2	3												
CO4	3	2		3										
CO5	3	3												
CO6								3						
CO7									2					
CO8										3				
CO9												3		
average	**2.8**	**2.8**	**2.5**	**3**	**-**	**-**	**-**	**3**	**2**	**3**	**-**	**3**	**3**	**2**

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B.Tech - II Semester

L	T	P	C
0	0	3	1.5

(18ES0207) BASIC ELECTRICAL ENGINEERING LAB
(Only for MECH)

OBJECTIVE:

To make the student learn about:

- Experimental verification of theorems
- Experimental verification of two port network parameters
- Analyze the performance of various machines

Any Ten of the following experiments are to be conducted.

1. Verification of KVL & KCL
2. Verification of Superposition Theorem with analysis.
3. Verification of Thevenin's Theorem with analysis.
4. Verification of Norton's Theorem with analysis.
5. Verification of Maximum Power Transfer Theorem with analysis.
6. Two Port Network Parameters – Z-Y Parameters,
7. Two Port Network Parameters – ABCD and H-Parameters.
8. Analysis of Series Resonance
9. Analysis of Parallel Resonance
10. OC & SC Test on Single phase Transformer
11. Load Test on Single phase Transformer
12. Brake Test on Single Phase induction Motor

Course	COURSE OUTCOMES	
Basic Electrical Engineering lab	**CO1**	To able to understand the verification of theorems(PO1) . (PO1, PO2, PO3)
	CO2	Apply the net work theorem suitably. (PO1, PO3,po4)
	CO3	To analyze the verification of Two port net work parameters(PO1, PO3,po4)
	CO4	Analyze electrical circuits using series and parallel Resonance (PO1, PO2, PO3)
	CO5	To Analyze the performance of various missions.(PO1,PO2,PO4) . (PO1, PO2, PO4).

	CO6	Follow the ethical principles in implementing the experiments (PO8)
	CO7	Do experiments effectively as an individual and as a team member in a group. (PO9)
	CO8	Communicate verbally and in written form, the understanding about the experiments. (PO10)
	CO9	Continue updating their skill related to net work, parallel resonance, missions experiments in future. (PO12)

CO-PO Mapping

Course	PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
Basic Electrical Engineering lab	CO1	2													
	CO2	3		2	3										
	CO3	2		2	3										
	CO4	3	2	2											
	CO5	2	2		2										
	CO6								3						
	CO7									2					
	CO8										3				
	CO9												3		
	average	2.4	2	2	2.6	-	-	-	3	2	3	-	3	2	2

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B.Tech - II Semester

L	T	P	C
0	0	0	0

(18MCBH02) ENVIRONMENTAL SCIENCE
(Common to all)

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

UNIT-I ECOSYSTEMS:

Definition, Scope and Importance of ecosystem – Structure and function of an ecosystem – Energy flow in the ecosystem – Food chain, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

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

UNIT-II NATURAL RESOURCES:

Classification of Resources: Living and Non-Living resources, **Water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III BIODIVERSITY AND BIOTIC RESOURCES:

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

UNIT-IV ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES:

Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Noise pollution

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

E– WASTE MANAGEMENT: Definition of E-Waste, Effect of E-Waste on Humans and Environment, Treating and management of E-Wastes.

UNIT – V SOCIAL ISSUES AND THE ENVIRONMENT:

Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Climate change, global warming, acid rain, ozone layer depletion,– Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Gain the knowledge of natural resources of the nation and to preserve and utilize it in an appropriate manner through various projects.	PO6, PO7, PO8
CO2	Understand the concepts of environment, ecosystem, biodiversity of the nation, social and ethical responsibilities of the engineer to the society.	PO6, PO7, PO8
CO3	Realize and create the public awareness regarding various environmental pollutions in the society and to control it through individual and team work for the environmental sustainability in ethical manner.	PO6, PO7, PO8
CO4	Acquire the knowledge of social issues and its impact on the environment, sustainable development, various acts and its amendments to protect the environment through various projects and disaster management.	PO6, PO7, PO8
CO5	Know about the increase in human population and its variation among nations, human rights, role of communication in environment and human health.	PO6, PO7, PO8

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela.2008 PHI Learning Pvt. Ltd.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1						3	3	2				
CO2						3	2	2				
CO3						3	3	2				
CO4						3	3	1				
CO5						2	2	1				
Average						**2.8**	**2.6**	**1.6**				

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B.Tech - III Semester

L	T	P	C
3	0	0	3

(18BSBH03) MATHEMATICS-III
(Common to EEE, MECH & ECE)

Course Objectives:

Our emphasis will be more on conceptual understanding and application of Laplace transforms, Fourier transforms, Solution of Algebraic, Transcendental Equations and Numerical solutions of ordinary differential equations.

UNIT– I Laplace Transform-I

Laplace transform of standard functions– First shifting Theorem - Second shifting theorem- Transforms of derivatives and integrals – Unit step function –Dirac's delta function-Laplace transform of periodic functions.

UNIT– II Laplace Transform-II

Convolution theorem- Differentiation and integration of transform – Inverse laplacetransform –Application of Laplace transforms to ordinary differential equations of first and second order.

UNIT – III Fourier Transform

Introdution–Fourier integral theorem (only statement) – Fourier sine and cosine integrals- Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

UNIT – IV Numerical Method-I

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method

Interpolation: Finite differences-Forward differences- Backward differences- Newton's forward and backward interpolation formulae – Lagrange's formulae.

UNIT – V Numerical Method-II

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method- Modified Euler's Method-Runge-Kutta Methods-Predictor-corrector method-Milne's Method.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Analyze the engineering problems using the concept of laplace transforms.	PO1,PO2,PO3, PO5,PO12
CO2	Solve the engineering problems using concept of fourier transforms	PO1,PO2,PO3, PO5,PO12
CO3	Gain knowledge to tackle engineering problems using the concepts of Numerical methods	PO1,PO2,PO3, PO5,PO12
CO4	Analyze the engineering problems using the concept of Numerical method-I	PO1,PO2,PO3, PO5,PO12
CO5	Analyze the engineering problems using the concept of Numerical method-II	PO1,PO2,PO3, PO5,PO12

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

REFERENCES:

1. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.
2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S. Chand publication.
3. Higher Engineering Mathematics, by B.V.Ramana, McGraw Hill publishers.
4. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

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B.Tech - III Semester

L	T	P	C
2	0	0	2

(18ES0402) BASIC ELECTRONICS ENGINEERING

Objectives:

To provide an overview of electronic device components to Mechanical engineering students

UNIT-I

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator.

UNIT-II

Introduction to BJT, its input-output and transfer characteristics, BJT as a single stageCE amplifier, frequency response and bandwidth, FET-input-output and transfer characteristics

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp inputmodes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study ofpractical op-amp IC 741, inverting and non-inverting amplifier applications: summing and differenceamplifier, unity gain buffer, comparator, integrator and differentiator.

UNIT-III

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as astable and
mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shiftand Wein bridge oscillator.

UNIT-IV

Digital Electronics Fundamentals :Difference between analog and digital signals, Boolean algebra,Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using Kmap,Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shiftregisters, counters, Block diagram of Microprocessor/microcontroller and their applications.

UNIT-V

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation
schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand the principles of semiconductor devices and their applications.	PO1,PO2,PO3, PO5,PO12
CO2	Design an application using Operational amplifier.	PO1,PO2,PO3, PO5,PO12
CO3	Understand the working of timing circuits and oscillators.	PO1,PO2,PO3, PO5,PO12
CO4	Understand logic gates, flip flop as a building block of digital systems.	PO1,PO2,PO3, PO5,PO12
CO5	Learn the basics of Electronic communication system.	PO1,PO2,PO3, PO5,PO12

Text Books:

1. Salivahanan, N.Suressh Kumar, A. Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill, Second Edition.
2. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International (p) Ltd,2nd Edition, 2003.
3. M.Morris Mano & Michel D. Ciletti,"Digital Design", 5th Edition Pearson.
4. Simon Haykin, "Communication Systems", Wiley-India edition, 3rd edition, 2010.

References:

1. J. Millman and C.C. Halkias, "Integrated Electronics", McGraw-Hill, 1972.
2. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", PHI, 4th edition, 1987.
3. Mobile cellular telecommunications-W .C. Y. Lee, Tata Mc-Graw Hill, 2nd Edition,2006.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2		2							3
CO2	3	2	2		2							3
CO3	3	3	2		2							3
CO4	3	3	1		1							3
CO5	2	2	1		1							2
Average	**2.8**	**2.6**	**1.6**		**1.6**							**2.8**

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B.Tech - III Semester

L	T	P	C
3	0	0	3

(18PC0301) MATERIAL SCIENCE ENGINEERING

Course Objectives:

To gain and understanding of the relationship between the structure, properties, processing, testing, heat treatment and applications of metallic, non metallic, ceramic and composite materials so as to identify and select suitable materials for various engineering applications.

UNIT-I

Structure of Metals - Bonds in Solids - crystallization of metals, Properties of Metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT-II

Equilibrium of Diagrams - Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, and Fe-Fe_3C

UNIT-III

Ferrous and Non – Ferrous Metals and Alloys - Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure
and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels, Copper and its Alloys, Aluminium and its Alloys.

UNIT-IV

Heat Treatment of Metals - Effect of alloying elements on Iron – Iron carbon system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys. Heat treatment of plastics

UNIT-V

Ceramic Materials - Crystalline Ceramics, Glasses, Cermets and Composite materials classifications and applications. Basic steps of powder metallurgy, Characterization, Sintering, Sintered Products, Applications of powder metallurgy in Indian industries.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understands the grains in crystallization, its effect on the properties, and analyzing the microstructures of metals.	P01,P02,P03,P04
CO2	Apply the knowledge of mathematics, science, and engineering fundamentals of alloys and Phase diagram of various materials and the classification of micro structure in steel and cast iron.	P01,P02,P03,P04
CO3	Understand the engineering knowledge of ferrous and non-ferrous metal and its alloys. Identify, formulate the appropriate techniques and engineering application of ferrous and non-ferrous metal and alloys.	P01,P02,P03,P04
CO4	Acquire the knowledge of engineering fundamentals for heat treatment process. Identify, formulate, analysis and apply appropriate techniques used in all the heat treatment process with an understanding of its limitations.	P01,P02,P03,P04
CO5	Understand the engineering knowledge of polymers, ceramics and composites. Identify, formulate the appropriate techniques and engineering application of polymers, ceramics and composites.	P01,P02,P03,P04

Text Books:

1. Introduction to Physical Metallurgy, Sidney H. Avener.
2. Materials Science and Engineering, by Raghavan V, PHI Publisher.
3. Material Science and Metallurgy / Kodgire.

REFERENCES:

1. Science of Engineering Materials / Agarwal
2. Materials Science and Engineering / William and Callister.
3. An introduction to materials Science / W. G. Vinas& HL Mancini
4. Material science & material / C. D. Yesudian& Harris Samuel
5. Engineering Materials and their Applications – R. A Flinn and P K Trojan / Jaico Books.
6. Engineering materials and metallurgy / R. K. Rajput/ S. Chand

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	2	2	2								
CO3	3	3	2	2								
CO4	3	3	1	1								
CO5	2	2	1	1								
Average	**2.8**	**2.6**	**1.6**	**1.6**								

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B.Tech - III Semester

L	T	P	C
2	1	0	3

(18PC0302) ENGINEERING THERMODYNAMICS

Course Objectives:

- To understand the basic laws of thermodynamics and their application to the non-flow and flow processes.
- To understand the thermodynamic properties of ideal and real gases, gaseous mixtures.
- To get the awareness on thermodynamic principles, skills to perform the analysis and design of thermodynamic systems.

UNIT-I

Basic Concepts of Thermodynamics - Microscopic and Macroscopic approach, Thermodynamic systems, homogeneous & heterogeneous systems, control volume, property, point and path functions, Thermodynamic equilibrium, State, Path and process, Reversible and Quasi-static process, Concept of Continuum, Work transfer and Heat transfer, Zeroth law, Concept of temperature and heat

UNIT-II

First Law of Thermodynamics - First law, First Law applied to a process and a cycle, Energy - a property, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I. Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

UNIT-III

Second Law of Thermodynamics - Second law – Kelvin, Planck and Clausius statements, Heat engine, Refrigerator and Heat pump, Efficiency and COP, Thermodynamic temperature scale, Reversibility and Irreversibility, Carnot cycle, Clausius Inequality

Entropy - Concept of entropy, Entropy of ideal gases, Principle of increase of entropy, Quality ofenergy, Energy (Availability), Reversible work, Energy and Irreversibility for closed system and control volume, Second law efficiency.

UNIT-IV

Properties of pure substances -Introduction, P-V, P-T and T-S Diagrams for a Pure Substance, Quality and Dryness Fraction, Use of Steam Tables and Mollier Chart for thermodynamic properties.

Properties of gases and gas mixtures - Ideal gas, equation of state, Mole Fraction, Mass fraction, Gravimetric and volumetric Analysis, Dalton's Law of partial pressure, Equivalent Gas constant and Molecular Internal Energy, Enthalpy, Specific Heats and Entropy of Mixture of perfect Gases and Vapour.

UNIT-V

Air standard cycles - Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles,Second Law Analysis of Gas Power Cycles.

Refrigeration Cycles -Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell- Coleman cycle, Vapour compression cycle-performance Evaluation

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Demonstrate knowledge and understanding the concept of conservation of mass, energy, work interaction, heat transfer.	PO1, PO2, PO3, PO4
CO2	Identify, formulate and analyze various thermodynamic systems and provide analytical and numerical solutions.	PO1,PO2, PO3, PO4
CO3	Identify closed and open systems and/or apply the concept of second law to analyze simple systems and understand the various thermodynamic equations, functions and relations.	PO1, PO2, PO3, PO4
CO4	Evaluate properties of pure substances and gas mixtures and use steam tables and Mollier chart in solving complex problems.	PO1, PO2, PO3, PO4
CO5	Understand the various psychrometric relations, properties and analyze air standard cycles applied in enginesand identify methods to improve thermodynamic performance.	PO1, PO2,PO3, PO4

TEXT BOOKS:

1. Engineering Thermodynamics, P. K. Nag, TMH, 5th Edition, 2013.
2. Engineering Thermodynamics, Chatttopadhyay, Oxford Publishers, 1st edition, 2011.

REFERENCE BOOKS:

1. Thermodynamics–An EngineeringApproach, YunusCengel& Boles, TMH, 8th Edition, 2015
2. Fundamentals of Engineering Thermodynamics, Dr.R.Yadav, Central publishing House, 7th Edition, 2004.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	2	2	2								
CO3	3	3	2	2								
CO4	3	3	1	1								
CO5	2	2	1	1								
Average	**2.8**	**2.6**	**1.6**	**1.6**								

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B.Tech - III Semester

L	T	P	C
3	1	0	4

(18PC0303) MECHANICS OF SOLIDS

Course Objectives:

Analysis of stresses and strains of mechanical and structural components; action of shear; bending and torsional stresses; deflection of beams due to axial and transverse loadings; thin and thick walled pressure vessels.

UNIT-I

Simple Stresses & Strains - Introduction, Types of stresses & strains, Hooke's law, Stress-Strain diagram for mild steel, Working stress, Factor of safety, Poisson's ratio, Volumetric strain, Elastic Moduli and relationship between them – Bars of varying section, Composite bars, Temperature stresses. Strain energy – Resilience – Gradual, Sudden, Impact loadings.

Principal Stresses & Strains - Plane stress, Plane strain, Computation of Principle Stresses and Strains on inclined planes, Mohr's circle of stresses.

UNIT-II

Shear Force and Bending Moment - Definition of beam, Types, Concept of Shear force and Bending moment – S.F and B.M diagrams for Cantilever, Simply supported and Overhanging beams subjected to point loads, U.D.L., U.V.L. 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

Bending Stresses and Shear Stresses - Theory of simple bending, Bending equation, Determination of Bending Stresses for simple cases, Section modulus, Shear stress formula, Shear stress distribution across various beams & sections - Rectangular, Circular, Triangular, I, T sections.

Torsion of Circular Shafts and Springs - Theory of pure torsion, Torsion Equation, Torsional moment of resistance, Polar section modulus.

UNIT-IV

Deflection of Beams - Bending into a circular arc – Slope, Deflection and Radius of curvature , Determination of Slope and Deflection for Cantilever and Simply supported beams subjected to Point loads, U.D.L & U.V.L. Double integration and Macaulay's methods.

Columns - Introduction, Failure of a Column, Columns with Hinged ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula.

UNIT-V

Thin Cylinders - Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses, Volumetric strains – changes in dia, and volume of thin cylinders ,Thin spherical shells.

Thick Cylinders - Lame's equation, Cylinders subjected to inside & outside pressures, Compound cylinders.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Apply the knowledge of mathematics, basic theory of science, fundamental principles to attain the solution of complex engineering problems on deformation of materials.	PO1,PO2,PO3,PO4
CO2	Identify, formulate to perform the stress analysis of a beam under axial loading, torsion, transverse loading to provide valid conclusions.	PO1,PO2,PO3,PO4
CO3	Evaluate & interpreted the various stresses and deformation in circular and hollows shafts, sections to analyze complex engineering problems.	PO1,PO2,PO3,PO4
CO4	Analyze and understand the fundamental concepts of deflection of beam by various methods.	PO1,PO2,PO3,PO4
CO5	Apply reasoning informed by the contextual knowledge to perform stress and strain deformations in Thin , Thick Cylinders, spherical shells	PO1,PO2,PO3,PO4

Text Books:

1. Strength of Materials by R.Subramaniam, oxford publishers.
2. Strength of Materials by R.K. Bansal, Laxmi Publishers, 5th Edition,2012.
3. Mechanics of Materials,AndrewsPytel,JaanKiusallaas&M.M.M.Sarcar (Second Edition), Cengage Learning Publishers.

Reference Books:

1. Strength of Materials by S. Ramamrutham, DhanpatRai Publishers
2. Strength of Materials by R.K. Rajput, S.Chand& Company, 5th Edition,2012.
3. Strength of Materials by Dr. Sadhu Singh, Khanna Publishers, 10th Edition,2013.
4. Strength of Materials by M.Chakraborti, S.K.Kataria& Sons, 2nd Edition,2011.
5. Strength of Materials by S S Rattan, The McGraw-Hill Companies, 2nd Editon,2011.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	2	2	2								
CO3	3	3	2	2								
CO4	3	3	1	1								
CO5	2	2	1	1								
Average	**2.8**	**2.6**	**1.6**	**1.6**								

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B.Tech - III Semester

L	T	P	C
0	0	3	1.5

(18PC0304) MATERIAL TESTING LAB

Course Objectives:

- Experiments to find Types of Metals, Steels, Cast irons and their Microstructures;
- To determine Mechanical Properties of Various Engineering materials

LIST OF EXPERIMENTS

1. Tensile Test on UTM (MS/Al)
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test on Mild Steel rod
4. Brinell and Rockwell hardness tests
5. Compression test on helical spring
6. Compression test on Wood or Brick
7. Impact test
   a) Izod Test
   b) Charpy Test
8. Study of metallurgical instruments & microscope
9. Hardeneability of steels by Jominy End Quench Test.
10. Preparation and study of the microstructure of Mild Steel
11. Preparation and study of the microstructure of Aluminium
12. Study of the Micro Structures of Non Ferrous Alloys and Heat treated Steels

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate the knowledge on the microstructure of materials	PO1
CO2	Analyze the mechanical properties of materials by suitable testing.	PO2
CO3	Design the materials strength using various impact and deflection test.	PO3
CO4	Conduct investigation on the harness of different materials	PO4
CO5	Evaluate the structure of the material by using modern microscope	PO5
CO6	Follow the ethical principles while doing the experiments	PO8
CO7	Do the experiments effectively as an individual and as a team member in a group.	PO9
CO8	Communicate verbally and in written form pertaining to results of the experiments	PO10
CO9	Continue updating their skill related to material science in future.	PO12

CO-PO Mapping

Course	PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Basic Electrical Engineering lab	CO1	3											
	CO2		3										
	CO3			3									
	CO4				3								
	CO5					3							
	CO6								3				
	CO7									2			
	CO8										3		
	CO9												3
	average	3	3	3	3	3			3	2	3		3

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B.Tech - III Semester

L	T	P	C
0	0	3	1.5

(18ES0303) MACHINE DRAWING LAB

Course Objectives:

To make the students to understand the concepts of I.S. conventions, methods of dimensioning, draw the surface developments and draw assemblies of machine parts and to draw their sectional views.

UNIT-I

Machine Drawing Conventions - Need for drawing conventions- introduction to IS conventions Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned.

Perspective Projections - Perspective View of simple Solids, Visual Ray Method, Vanishing point method.

Ex. 01: Material and Machine Elements Representation

Ex. 02: Perspective Projections

UNIT-II

Drawing of Machine Elements and simple parts - Selection of Views, additional views for the following machine elements and parts with drawing proportions: Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws, Keys, cottered joints and knuckle joint, Rivetted joints for plates, flanged & protected flanged joint. Shaft coupling, spigot and socket pipe joint. Journal, and foot step bearings.

Ex. 03: Machine Parts Representation

Ex. 04: Couplings

UNIT-III

Drawings of assembled views for the part drawings of the following. Engine parts - Stuffing boxes, Eccentrics, Petrol Engine-connecting rod, Screw jack, Single tool post.

Conversion of assemble drawing to Part Drawing:

Ex. 05: Assembly Drawing (Stuffing box)

Ex. 06: Assembly Drawing (Eccentric)

Ex. 07: Assembly Drawing (Connecting rod)

Ex. 08: Assembly Drawing (Screw jack)

Ex. 09: Assembly Drawing (Single tool post)

Ex. 10: Part Drawing

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Course Outcomes:

On successful completion of the course, students will be able to:		POs related to COs
CO1	Understand the importance of engineering and working drawings with dimensions and bill of material during design and development.	PO1, PO2, PO3, PO4
CO2	Demonstrate knowledge and understanding the selection of section planes, drawing of sections and auxiliary sectional views	PO1, PO2, PO3, PO4
CO3	Design and Develop the simple mechanical, coupling parts	PO1, PO2, PO3, PO4
CO4	Develop the skill of assembling the reciprocating engine parts	PO1, PO2, PO3, PO4
CO5	Demonstrate knowledge on the assembly the machine parts	PO1, PO2, PO3, PO4

Text Books:

1. Machine Drawing – N Siddeswar, P. Kannaiah, VVS Sastry, McGraw Hill,2015
2. Machine Drawing- K.L. Narayana, P.Kannaiah&K.Venkata Reddy, New Age Publishers, 4th Edition, 2012.

Reference Books:

1. Machine Drawing- P.S. Gill, S.K. Kataria& Sons, 17th Edition, 2012.
2. Machine Drawing- Dhawan, S.Chand Publications, 1st Revised Edition,1998.
3. Machine Drawing – Ajeet Singh, McGraw Hill, 2012
4. Machine Drawing- Luzzader, PHI Publishers,11th Edition.
5. Textbook of Machine Drawing-K.C.John,2009, PHI learning, 1st Edition.

NOTE:

- The End exam will be for 4 hrs in the following format
- All answers should be on the drawing sheet only. Answers on the drawing sheet only will valued.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	2	2	2								
CO3	3	3	2	2								
CO4	3	3	1	1								
CO5	2	2	1	1								
Average	**2.8**	**2.6**	**1.6**	**1.6**								

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B.Tech - III Semester

L	T	P	C
0	0	2	1

(18HSBH03) SOFT SKILLS
(Common to all)

The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts

Objectives:

- To bring about a consistent accent and intelligibilty in students' pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize their mother tongue influence
- To train students to use language appropriately for public speaking and interviews and group discussion

Outcomes:

- Become active participants in the learning process and acquire proficiency in spoken English
- Speak with clarity and confidence thereby enhances employability skills.

UNIT – I

1. Communication skills
2. Introducing yourself
3. Story telling
4. Telephonic communication

UNIT – II

1. Writing skills
2. Narrating an images
3. Business letters
4. E-mail writing
5. Report writing

UNIT – III

1. Time Management and Goal setting

UNIT – IV

1. Making effective presentations
2. Speaking on various occasions
3. Resume preparations

UNIT – V

1. Group discussions
2. Interview skills

3. Leaderships skills

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	To remember and understand the different aspects of the English Language proficiency with emphasis on LSRW skills.	PO1
CO2	To analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking by group discussion.	PO2
CO3	Use of modern computing facilities and suitable software tools to improve the communication skills and elocution.	PO5
CO4	Follow the ethical principles to prepare the group tasks	PO8
CO5	Perform exercise individually and also a team to complete the task	PO9
CO6	To apply communication skills through various language learning activities.	P10
CO7	To create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.	P12

Sugested Software:

1. K – Van Advanced Communication Skills
2. Globareena Communication skills Software

References:

1. D. Sudha Rani, A Manual for English language Laboratory, Pearson Education.
2. D. Sudha Rani, Advanced Communication Skills Laboratory, Pearson Education.
3. R. Manivannan and G.Immanueal, Communication Skills Laboratory, VK .Publications
4. Nira Kumar, English Language laboratories, PHI Learning Pvt.Ltd.New Delhi.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3											
CO2		2										
CO3					3							
CO4								3				
CO5									2			
CO6										2		
CO7												2
Average	**3**	**2**			**3**			**3**	**2**	**2**		**2**

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B.Tech - III Semester

L	T	P	C
2	0	0	0

(18MCBH03) CONSTITUTION OF INDIA

Course Objectives:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes:

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

UNIT-I

- Meaning of the Constitution Law

UNIT-II

- Historical Perspective of the Constitution of India
- Salient features and characteristics of the Constitution of India

UNIT-III

- Scheme of the fundamental rights
- The scheme of the Fundamental Duties and its legal status
- The Directive Principles of State Policy – Its importance and implementation
- Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT-IV

- Parliamentary Form of Government in India – The constitution powers and status of the President of India.
- Amendment of the Constitutional Powers and Procedure.
- The historical perspectives of the constitutional amendments in India.
- Emergency Provisions : National Emergency, President Rule, Financial Emergency

UNIT-V

- Local Self Government – Constitutional Scheme in India.
- Scheme of the Fundamental Right to Equality.
- Scheme of the Fundamental Right to certain Freedom under Article 19
- Scope of the Right to Life and Personal Liberty under Article 21

Course Outcomes:

On successful completion of the course the student will be able to		**POs related to COs**
CO1	Understand the functions of the Indian constitution	PO6, PO8,PO12
CO2	Recognize the structure, functions of Indian central government	PO6, PO8,PO12
CO3	Realize the structure and functions of State government in India	PO6, PO8,PO12
CO4	Explain the functions of local administration in rural and urban	PO6, PO8,PO12
CO5	Understand the role of state and chief election commission	PO6, PO8,PO12

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Framing of Indian Constitution, Dr. S. N. Busi, Dr. B. R. Ambedkar 1st Edition, 2015

Reference Books:

1. Indian Constitution Law, M. P. Jain 7th Edn., Lexis Nexis, 2014.
2. Introduction to the Constitution of India, D.D. Basu, Lexis Nexis, 2015.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1						3		2				2
CO2						2		2				2
CO3						3		2				2
CO4						3		1				1
CO5						2		1				1
Average						**2.6**		**1.6**				**1.6**

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B.Tech - IV Semester

L	T	P	C
3	0	0	3

(18BSBH05) PROBABILITY & STATISTICS
(Common to MECH & CIVIL)

Course Objectives:

The main objective of this course is to provide student with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like climate prediction and computer network etc.

Outcomes:

- Probability , probability distributions can be used in many places like academics, real life problems for decision making.
- The statistical techniques like regressions, correlation can be used for finding qualitative and quantitative relation between two or more variables.
- Test of significance and hypothesis will be useful for them in taking decisions .
- The students will understand the use of statistical techniques in every walk of life.

UNIT- I Probability

Basic concepts of probability -Sample space - Addition theorem - Conditional probability independence - Baye's Theorem - Random variables – Discrete and continuous random variables - Expectation of random variables-probability density function - probability distribution function.

UNIT - II Distributions

Measures of dispersion -moments-skewness and kurtosis– Distributions –Binomial Distribution - Poisson Distribution- Normal Distribution - related properties.

UNIT – III Curve fitting, Correlation and Regression

Curve fitting by the method of least squares: fitting of straight lines- second degree parabolas and more general curves (Exponential & Power curve) - Covariance- Correlation- Types- Pearson's Coefficient of correlation - Rank correlation - Spearman's rank correlation. Regression - Regression lines - Multiple regression.

UNIT - IV Testing of hypothesis

Small Sample –student t-test – F-test - chi square test - estimation of proportions -Large sample test for single proportion - difference of proportions - single mean- difference of means- and difference of standard deviations.

UNIT - V Control charts

Statistical quality control: Defects and Defectives - Cause of variations - The principle of shewhart control charts for attribute and variable quality characteristics – Construction and operations of charts.

Course Outcomes:

On successful completion of the course the student will be able to		POs related to COs
CO1	Probability, probability distributions can be used in many places like academics, real life problems for decision making.	PO6, PO8,PO12
CO2	The statistical techniques like regressions, correlation can be used for finding qualitative and quantitative relation between two or more variables.	PO6, PO8,PO12
CO3	Test of significance and hypothesis will be useful for them in taking decisions .	PO6, PO8,PO12
CO4	The students will understand the use of statistical techniques in every walk of life	PO6, PO8,PO12
CO5	Understand the use of control charts	PO6, PO8,PO12

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
2. Statistical methods by S.P. Gupta, S.Chand publications.
3. Probability & Statistics by T.K.V. Iyengar, S.Chand publications.

Reference Books:

1. Probability and Statistics for Engineering and Sciences by Jay L.Devore, CENGAGE.
2. Probability & Statistics for engineers by Dr. J. Ravichandran WILEY-INDIA publishers.
3. Probability and Statistics by R.A. Jhonson and Gupta C.B.
4. Probability & Statistics by E. Rukmangadachari& E. Keshava Reddy, Pearson Publisher.
5. Probability & Statistics for Science and Engineering by G.ShankarRao, Universities Press.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1						3		2				2
CO2						2		2				2
CO3						3		2				2
CO4						3		1				1
CO5						2		1				1
Average						**2.6**		**1.6**				**1.6**

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B.Tech - IV Semester

L	T	P	C
3	0	0	3

(18HS0112) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives:

The objective of this course is to equip the student with the basic inputs of Managerial Economics and
Economic Environment of business and to enrich analytical skills in helping them take sound financial decisions for achieving higher productivity.

Course Outcomes:

The thorough understanding of Managerial Economics and Analysis of Financial Statements facilitates the Technocrats – cum – Entrepreneurs to take-up decisions effectively and efficiently in
the challenging Business Environment.

UNIT - I

INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics - Definition, nature and scope –Role of Managerial Economics in Business Decisions- Demand Analysis: Determinants- Law of Demand - Elasticity of Demand.
Significance – types – measurement of elasticity of demand - Demand forecasting- factors governing
Demand forecasting- methods of demand forecasting

UNIT - II

THEORY OF PRODUCTION AND COST ANALYSIS

Production Function – Short-run and long- run production - Isoquants and Isocosts, MRTS, least cost
Combination of inputs - - laws of returns - Internal and External Economies of scale - **Cost Analysis**: Cost concepts- Time Value of Money - Break-Even Analysis (BEA) – Managerial Significance and limitations of BEA - Determination of Break Even Point (Simple Problems)

UNIT - III

INTRODUCTION TO MARKETS AND FORMS OF BUSINESS ORGANIZATIONS

Market structures: Types of Markets - Perfect and Imperfect Competition - Features, Oligopoly -
Monopolistic competition. Price-Output determination - Pricing Methods and Strategies. Forms of Business Organization – Sole Proprietorship- Partnership – Joint Stock Companies –National Income: Concepts-Inflation: Types – Business Cycle: Phases of business cycle

UNIT - IV

INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Financial Accounting – Concept - emerging need and importance - Double-Entry Book Keeping-

Journal - Ledger – Trial Balance - Financial Statements - - Trading Account – Profit & Loss Account – Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Techniques –

Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

UNIT - V

CAPITAL AND CAPITAL BUDGETING

Concept of Capital - Sources of Short term and Long term capital - Estimating Working Capital requirement – Capital budgeting – Features of Capital budgeting proposals – Methods and Evaluation of Capital budgeting – Pay Back Method –Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Describe the Characteristics of successful product development in an organization	**PO1,PO2,PO3**
CO2	Evaluate the product planning and product specification of a product	**PO1,PO2,PO3**
CO3	Understand the generation, selection and testing of a product concept	**PO1,PO2,PO3**
CO4	Develop product architecture and design for manufacturing new product	**PO1,PO2,PO3**
CO5	Understand the principles of prototypes, economics and project management	**PO1,PO2,PO3,PO11**

Text Books:

1. Aryasri: Managerial Economics and Financial Analysis, 4/e, TMH, 2009.
2. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2009.

Reference Books:

1. PremchandBabu, MadanMohan:Financial Accounting and Analysis,Himalaya, 2009
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International,. 2009.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2009.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2									
CO2	3	2	2									
CO3	3	2	2									
CO4	3	2	2									
CO5	3	2	2								2	
Average	**3**	**2**	**2**								**2**	

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B.Tech - IV Semester

L	T	P	C
2	1	0	3

(18PC0305) KINEMATICS OF MACHINERY

Course Objectives:

- To understand the basic concepts of mechanisms, cam, gear train and their kinematics.
- To understand the effects of friction in the motion of machine components.

UNIT-I

Basics of Mechanisms - Classification of links and kinematic pairs – Sliding, Turning, Rolling, Screw and spherical pairs- Lower and higher pairs- Degree of freedom, Mobility – Kutzbach criterion, Grubler's criterion – Grashof's Law

Kinematic Inversions of four-bar chain, Single and double slider crank chains –Quick return mechanisms Straight line motion mechanisms, Peaucellier, Hart, Scottrussel, Grasshopper, Watt, Tchebicheff, Robert and pantograph.

UNIT-II

Steering Mechanisms - Conditions for correct steering – Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling) -Single and double Hooke's joint — applications – Simple problems.

Belt Drives - Introduction, Belt drives, selection of belt drive- types of belt drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt.

UNIT-III

Kinematics - Displacement, Velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration of polygons

Velocity Analysis using instantaneous centers – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration

UNIT-IV

Cams - Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, Parabolic and Simple harmonic motions.

Cam Profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – Sizing of cams.

UNIT-V

Gears - Law of toothed gearing – Involutes and Cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – Contact ratio –Condition for constant

velocity ratio for transmission of motion - Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears

Gear Trains – Introduction –Types of gears – Simple, compound, reverted and Epicyclic gear trains. Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains.Differential gear of an automobile.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Define link, pairs, mechanisms, inversion, structure and machines. Explain various terminologies associated with theory of machine. Draw inversions of different mechanisms.	PO1, PO2, PO3, PO4
CO2	Explain steering geometry. Describe various steering mechanisms with its need and importance. Identify various linkages of steering mechanisms, steering gears.	PO1, PO2, PO3, PO4
CO3	Draw velocity and acceleration diagram for a given mechanism. Calculate velocity and acceleration from a given mechanism.	PO1, PO2, PO3, PO4
CO4	Explain different types of cams and cam followers and its motions. Construct different types of CAM profile for a given data.	PO1, PO2, PO3, PO4
CO5	Develop a practical approach to optimizing gear trains with spur gears based on a selection matrix of optimal materials, gear ratios and shaft axes positions.	PO1, PO2, PO3, PO4

Text Books:

1. Theory of Machines, S.S. Rattan, Tata McGraw-Hill, 3rd Edition, 2013.

2. Theory of Machines, R.S Khurmi,, S Chand Publications, 14th Edition, 2005 .

3. Kinematics and Dynamics of Machinery, R.L.Norton, Tata McGraw-Hill, 1st Edition, 2013.

References Books:

1. Theory of Machines and Mechanisms, J.E. Shigley 4rd Edition" Oxford International student Edition

2. Theory of Machines, Thomas bevan, Pearson (P), 3 rd Edition, 2012

3. Mechanics of Machines, Ramamurthy, V. Narosa Publishing House, 2002

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	2	2	2								
CO3	3	3	2	2								
CO4	3	3	1	1								
CO5	2	2	1	1								
Average	**2.8**	**2.6**	**1.6**	**1.6**								

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B.Tech - IV Semester

L	T	P	C
2	1	0	3

(18PC0306) AIR COMPRESSOR & IC ENGINES

Course Objectives:

Comparison of air-standard and actual cycles; Components and working of 2-stroke and 4-stroke engines; Combustion phenomena in spark ignition and compression ignition engines; Performance parameters of an internal combustion engine; Estimating heat losses in an engine;Components and working of reciprocating and rotary compressors.

UNIT-I

Air Compressors - Reciprocating Compressors, effect of Clearance volume in compressors, volumetric Efficiency, single stage and multi stage compressors, effect of inter cooling and pressure drop in multi stage compressors, working principles of Roots , Vane type Compressor, Centrifugal Compressor; Axial Flow Compressors.

UNIT-II

I.C. Engines - Basic engine components, Classification of I.C. Engines, working of two stroke and four stroke engines, comparison of two stroke and four stroke engines, comparison of SI and CI engines, valve and port timing diagrams, application of I.C. engines, fuel-air cycles: Composition of cylinder gases, variable specific heats, dissociation, number of moles, Actual cycle: heat loss, time loss, exhaust blow down factors and loss due to rubbing friction.

UNIT-III

Combustion in S.I. and C.I. Engines - Normal combustion and abnormal combustion in S.I. engines, flame propagation and effect of engine variables, stages of combustion, pre-ignition and knocking, types
of combustion chambers in S.I engines, fuel Requirements and fuel rating. Stages of combustion in C.I. Engines, factors affecting delay period, phenomenon of knock in C.I. Engine, comparison of knock in S.I. and C.I engine s, types of combustion chamber s in C. I. Engines, fuel requirements and fuel rating.

UNIT-IV

Engine Performance Parameters - Brake power, indicated power, friction power, mean effective pressure, engine efficiencies, performance calculations and heat balance.

Measurement of Brake power - Rope brake, Hydraulic, Eddy current and swinging field DC Dynamometers; Measurement of Friction Power: William's line method,

Testing - Morse test, Motoring Test and Retardation Test, air and fuel measurement.

UNIT-V

Non-Conventional Engines - Working principles of CRDI engine, Dual fuel and Multi fuel engines, GDI engine, HCCI engine, Lean burn engines, Stirling Engine, stratified charge engines, VCR engine and Wankel engines.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate the basic knowledge of an air compressor in developing the analytical models	PO1, PO2, PO3, PO4
CO2	Know the basic knowledge of an engine, identify the types, components of IC engines and explain the functions of each.	PO1, PO2, PO3, PO4
CO3	Demonstrate the basic knowledge and analyze the types and stages of combustion in SI and CI engines.	PO1, PO2, PO3, PO4
CO4	Investigation on IC engines for performance improvement and emission reduction to environment.	PO1, PO2, PO3, PO4, PO7
CO5	Apply new combustion techniques to analyze the combustion in IC Engines.	PO1, PO2, PO3, PO4

Text Books:

1. Thermal Engineering,R.K.Rajput, Laxmi Publications, 8th Edition, 2010
2. I.C. Engines, V. Ganesan, TMH, 3rd Edition, 2008.

Reference Books:

1. Thermal Engineering,R.S.Khurmi& J.K. Guptha, S.Chand, 16thEdition, 2008.
2. I.C. Engines, Heywood, McGrawHIll. 1st Edition, 2013.
3. Engineering Fundamentals of IC Engines, Pulkrabek, Pearson, 2ndEdition, 2004.
4. Internal Combustion *Engines*, M.L Mathur&R.P.Sharma, DhanpatRai& Sons, 8th Edition, 2014.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	2	2	2								
CO3	3	3	2	2								
CO4	3	3	1	1			2					
CO5	2	2	1	1								
Average	**2.8**	**2.6**	**1.6**	**1.6**			**2**					

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B.Tech - IV Semester

L	T	P	C
3	0	0	3

(18PC0307) MANUFACTURING TECHNOLOGY

Course Objectives:

To understand the various manufacturing processes and machining related to casting, joining of metals, moulding and advanced processes.

- Metal forming, extrusion, processing of plastic materials and rapid manufacturing processes are highly nonlinear because they involve geometric, material and contact non linearity and hardening, hot and cold working process.

UNIT-I

Casting - Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction, Principles of Gating, Gating ratio and design of Gating

Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys. Risers – Types, function and design, casting design considerations, special casting processes 1) Centrifugal 2) Die, 3) Investment.

Methods of Melting- Crucible melting and cupola operation, steel making processes

UNIT-II

Metal Welding Processes -Introduction, Classification of Welding Processes - Arc Welding, TIG Welding, MIG Welding, Submerged Arc Welding; Gas Welding Process – Types of Flames; Resistance Welding – Spot Welding, Seam Welding; Thermit Welding, Electron Beam Welding, Laser Beam Welding, Ultrasonic Welding, Welding Defects – Causes and Remedies; Destructive and Non-destructive Testing of Welds, Soldering and Brazing.

UNIT-III

Metal forming processes - Introduction, Hot Working and Cold Working, Forging, Extrusion – Direct, Indirect and Tube Extrusion; Rolling – Types of Rolling Mills;
Principles of forging –Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects, Forces in forging of strip, disc and power requirements, applications, Equipment and their selection

UNIT-IV

Sheet Metal Operations - Economical Considerations - Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – Cup drawing and Tube drawing – coining – Hot and cold spinning. Force and power requirement in sheet metal operations, defects in sheet metal products – Equipment, tooling and their

UNIT-V

Plastic Processing - Introduction, Plastics – Properties of Plastics, Additives in Plastics; Types of Plastics- Thermoforming Plastics, Thermosetting Plastics; Injection Moulding,

Blow Moulding, Compression Moulding, Transfer Moulding, Extrusion Process, Calendering, Casting of Plastics, Sheet Forming Processes.

Course Outcomes:

On successful completion of the course the student will be able to		**POs related to COs**
CO1	Illustrate principles of foundry and recognize the different types of casting processes for manufacturing components and design the gating and riser system.	PO1, PO3
CO2	Demonstrate various types of joining processes and choose the appropriate one according to the application.	PO1, PO3
CO3	Explain the concept of forging, rolling and drawing operations.	PO1,PO3
CO4	Illustrate the various sheet metal forming processes for a specific application.	PO1, P03
CO5	Acquire the knowledge of metal powder production methods and classify different molding process and select suitable manufacturing process for the typical component with the aim of reducing cost and manpower.	PO1, P03, PO12

Text Books:

1. *Manufacturing Technology*, P.N. Rao, Vol.1, TMH, 4th Edition, 2013
2. *Manufacturing Engineering and Technology*, Kalpakjian, Serope, Pearson Education, 7th Edition, 2014.
3. *Elements of Workshop Technology*, HazraChoudary S.K. and HazraChoudary A.K., Vol I, Media Promoters, 12th Edition, 2007.

Reference Books:

1. *Production Technology*, R.K.Jain, Khanna Publishers, 17th Edition, 2010.
2. *Principles of Metal Castings*, Rosenthal, McGraw-Hill Professional Publishing, 3rd Edition, 2013.
3. *Fundamentals of Modern Manufacturing,Materials*, MikellP.Groover, *Processes and Systems*, John Wiley and Sons, 9th Edition, 2007.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3		2									
CO2	3		2									
CO3	3		2									
CO4	3		1									
CO5	2		2									2
Average	**2.8**		**1.8**									**2**

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B.Tech - IV Semester

L	T	P	C
0	0	3	1.5

(18PC0308) THERMAL ENGINEERING LAB

Course Objectives:

Calculating the performance parameters of 2-stroke and 4- stroke I.C. Engines; Heat balancing of an engine; Practicing the valve and port timing diagrams; Determining frictional power for single and multicylinder engines; Compressor performance. Assembly and disassembly of an automobile models; Determining the Fuel properties.

Course Outcomes:

Students undergoing this course are able to

- Demonstrate the theoretical knowledge of Thermal Engineering in finding the Performance of I.C. Engines.
- Analyze the Performance and Exhaust Emissions of an I.C. Engine by conducting various Tests.

LIST OF EXPERIMENTS

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines for CI Engines
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.
12. Engine Emission Measurement for SI & CI Engines.

Course Outcomes:

On successful completion of the course, students will be able to:		POs related to COs
CO1	Demonstrate the knowledge on Automobile system, engines and air compressor.	PO1
CO2	Identify and analyse various performance parameters of engines and compressors.	PO2
CO3	Develop systems to identify the performance parameters of engines and compressors and Dismantle and assemble various parts of transmission systems in automobile system.	PO3
CO4	Conduct investigation on performance of various engines, air compressors and provide valid conclusion about its efficiency, heat balance, engine friction, speed and retardation.	PO4

CO5	Follow ethical principle in conduction of experiments.	PO8
CO6	Perform individually and also in a team to complete the process	PO9
CO7	Communicate in verbally or in written form, their understanding about the experiments.	PO10
CO8	Continue updating their knowledge on various testing methods evolve in future for the identification of performance parameters of engines and compressors.	PO12

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2									
CO2	3	3	3									
CO3	2	3										
CO4	3	2		3								
CO5	3	3										
CO6								3				
CO7									2			
CO8										3		
average	**2.8**	**2.8**	**2.5**	**3**				**3**	**2**	**3**		

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B.Tech - IV Semester

L	T	P	C
0	0	3	1.5

(18PC0309) MANUFACTURING TECHNOLOGY LAB

Course Objectives:

• To understand the various manufacturing processes and machining related to casting, forming, joining of metals, moulding and extrusion processes of plastic materials.

Course Outcomes:

Students undergoing this course are able to

• Demonstrate knowledge of engineering principles (metallurgy, mechanics, and/or material science) in manufacturing processes.

• Use appropriate machine tool equipment, standardized methods and apparatus for manufacturing processes.

LIST OF EXPERIMENTS

I. METAL CASTING LAB:

a. Pattern Design and making - for one casting drawing.
b. Sand properties testing - Exercise -for strengths, and permeability – 1
c. Moulding: Melting and Casting - 1 Exercise

II. WELDING LAB:

a. Arc Welding: Lap & Butt Joint - 2 Exercises
b. Spot Welding - 1 Exercise
c. TIG Welding - 1 Exercise
d. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. MECHANICAL PRESS WORKING:

a. Blanking & Piercing operation and study of simple, compound and progressive press tool.
b. Hydraulic Press: Deep drawing and extrusion operation.
c. Bending and other operations

IV. PROCESSING OF PLASTICS:

a. Injection Moulding
b. Blow Moulding

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Gain the knowledge on the principles of foundry, the metal joining, forming processes	PO1
CO2	Analyze and choose the appropriate metal joining and forming processes.	PO2
CO3	Design and manufacturing components by adopting the concept of forging ,rolling and drawing operations.	PO3
CO4	Develop the plastic components using modern machine tools.	P05
CO5	Follow the ethical principles while doing the experiments	PO8
CO6	Do the experiments effectively as an individual and as a team member in a group.	PO9
CO7	Communicate verbally and in written form pertaining to results of the experiments	PO10
CO8	Continue updating their skill related to manufacturing process in future.	PO12

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3											
CO2		3										
CO3			3									
CO4					2							
CO5								3				
CO6									2			
CO7										3		
CO8												2
average	**3**	**3**	**3**		**2**			**3**	**2**	**3**		**2**

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B.Tech - IV Semester

L	T	P	C
0	0	0	0

(18MCBH04) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course objective

The course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

Unit-I

- Basic structure of Indian Knowledge System: Astadash Vidya- 4 ved
- 4 Upaved (Ayurved, Dhanurved, Gandharva Ved & Sthapthya Adi.,)

Unit-II

- 6 Vedanga (Shisha, Kalppa, Nirukha, VYkaran, Jyothish & Chand)
- 4 Upanga (Dharma Shastra, Meemamsa, Purana & Tharka Shastra)

Unit-III

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case studies

Unit-IV

- Philosophical Tradition (Sarvadarshan) Nyaya, Vyshepec,Sankhya, Yog, Meemamsa, Vedantha, Chavanka, Jain & Boudh
- Indian Linguistic Tradition –(Phonology, morphology, syntax and semantics)

Unit-V

- Indian Artistic Tradition - Chitra kala, Moorthi kala, Vasthu kala , Sthapthya, Sangeetha, Nruthya Yevam Sahithya
- Case studies

Text Books:

1. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014

2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
4. Fritzof Capra, Tao of Physics
5. Fritzof Capra, The Wave of life

References:

1. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam
2. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016
3. RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan, Delhi 2016
4. P B Sharma (English translation), Shodashang Hridayan
5. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
6. S.C. Chaterjee & D.M. Datta, An Introduction to Indian Philosophy, University of Calcutta, 1984
7. K.S. Subrahmanialyer, Vakyapadiya of Bhartrihari, (Brahma Kanda), Deccan College Pune 1965
8. Panini Shiksha, MotilalBanarasidas
9. V.N. Jha, Language, Thought and Reality, Vasudevasharan AGRAWAL Kala yevam Samskruthi, Shithya Bhavan Elahabad, 1952
10. Pramod Chandra, India Arts, Howard Univ. Press, 1983
11. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987
12. R. Nagaswamy, Foundations of Indian Art, Tamil Arts Academy, 2002

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B.Tech - V Semester (ME) **L T P C**

(18PC0310) DESIGN OF MACHINE ELEMENTS **2 1 0 3**

Course Objectives:

- To demonstrate how engineering design is used for many principles learned in previous engineering science courses and to show how these principles are practically applied.
- Students will become familiar on design principles, materials selection, stresses developed in machine elements under different loads.

UNIT - I

INTRODUCTION: General considerations of design, design process. Selection of Engineering Materials - properties –Manufacturing considerations in the design. BIS codes of materials, preferred numbers and interchangeability.

STRESSES IN MACHINE MEMBERS: Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation – Theories of failure – factor of safety.

UNIT - II

DESIGN FOR FLUCTUATING LOADS: Stress concentration –notch sensitivity – Design for fluctuating stresses – Estimation of Endurance strength – Goodman‟s line – Soderberg‟s line. Design of components for finite and infinite life.

UNIT - III

DESIGN OF RIVETED JOINTS: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

DESIGN OF BOLTED JOINTS: Forms of Screw threads. Stresses in Screw fasteners. Design of bolts with pre-stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength.

UNIT - IV

DESIGN OF COTTERS AND KNUCKLE JOINTS: Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints

DESIGN OF SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads.

UNIT - V

DESIGN OF KEYS AND COUPLINGS: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to Cos**
CO1	Understand the design concepts and analyze the stress development in machine elements.	**PO1,PO2, PO3**
CO2	Design the machine members subjected to static and variable loads.	**PO1,PO2,PO3**
CO3	Analyze the bolted and welded joints for various kinds of loads.	**PO1,PO2,PO3, PO4**
CO4	Design and analyze the temporary joints like cotter, knuckle and screwed joints.	**PO1,PO2,PO3,PO4**
CO5	Design and analyze the shafts and couplings for	**PO1,PO2,PO3, PO4**

	various applications.	

Text Books:

1. MachineDesign, Schaum'sseries, TMH Publishers, NewDelhi, 1st edition, 2011
2. MachineDesign, R.S. Kurmi and J.K. Gupta ,S.ChandPublishers, NewDelhi

Reference Books:

1. MachineDesign, R.K.Jain, KhannaPublishaers,New Delhi.
2. MachineDesign, SadhuSingh,KhannaPublishers, NewDelhi
3. DesignofMachineElements, M.F.Spotts, PHIPublishers, NewDelhi.

NOTE: Design data books are not permitted in the examinations.

CO-PO Mapping

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2									
CO2	3	2	2									
CO3	3	1	2	1								
CO4	3	2	2	1								
CO5	3	2	2	1								
Average	**3**	**1.8**	**2**	**1**								

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B.Tech - V Semester (ME) **L T P C**

(18PC0311) DYNAMICS OF MACHINERY **2 1 0 3**

Course Objectives:

- To understand the method of static force analysis and dynamic force analysis of mechanism, undesirable effects of unbalance in rotors and engines.
- To understand the concept of vibratory systems and their analysis and also the principles of governors.

UNIT- I

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

CLUTCHES: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

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

UNIT- II

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

TURNING MOMENT DIAGRAMS AND FLY WHEELS: Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching machines.

UNIT- III

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

UNIT- IV

BALANCING: Balancing of rotating masses - single and multiple – single and different planes.

BALANCING OF RECIPROCATING MASSES: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V-engine, multi cylinder in-line and radial engines for primary and secondary balancing.

UNIT- V

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

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Analyze the effects of friction in clutches, brakes and dynamometers.	PO1, PO2 ,PO3, PO4
CO2	Understand the gyroscopic effects on Aeroplane, ship, four wheel and two wheel vehicles, solving problems on gyroscopic effects and flywheels.	PO1, PO2, PO3, PO4
CO3	Understand and analyze the different types of governors.	PO1, PO2, PO3, PO4
CO4	Analyze the undesirable effects of unbalances resulting from prescribed motions in mechanism.	PO1, PO2, PO3, PO4
CO5	Understand free and forced vibrations and evaluate the critical speed of the shaft.	PO1, PO2, PO3, PO4

Text Books:

1. Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.
2. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.

Reference Books:

1. Theory of Machines, Thomas Bevan, Pearson, 3rd Edition,2012.
2. The theory of Machines, Ballaney, Kanna Publishers
3. Theory of Machines and Mechanisms of Shigley et.al. Oxford International Student Edition.

NOTE: End Exam Should be conducted in Drawing Hall

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2									
CO2	3	2	2									
CO3	3	2	1	1								
CO4	3	2	2	1								
CO5	2	2	2	1								
Average	**2.8**	**2**	**1.8**	**1**								

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B.Tech - V Semester (ME) **L T P C**

(18PC0312) APPLIED THERMAL ENGINEERING **3 0 0 3**

Course Objectives:

- To provide a sound knowledge in various aspects of thermal equipments.
- To increasingly dominant role to play in the vital areas of power generation, Automobiles, R&AC and energy sector.
- The course contents aims at developing the necessary analytical and technical contents among engineers in these areas.
- The students shall become familiar with steam power plant, boilers, function of nozzle, gas turbines and jet propulsions

UNIT- I

BASIC CONCEPTS: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

UNIT- II

BOILERS: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers – Mountings and Accessories.

DRAUGHT: Classification – Height Of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney – Artificial Draught, Induced and Forced Draught.

UNIT- III

STEAM NOZZLES: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal and Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio.

CRITERIA FOR DESIGN OF NOZZLE SHAPE: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line –Shock at The Exit.

CONDENSERS: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

UNIT- IV

IMPULSE TURBINE: Mechanical Details – Velocity Diagram – Effect of Friction – Power Developed, Axial Thrust Blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine - Its Features. Methods To Reduce Rotor Speed - Velocity Compounding And Pressure Compounding, Velocity And Pressure Variation Along The Flow – Combined Velocity Diagram For A Velocity Compounded Impulse Turbine.

REACTION TURBINE: Mechanical Details – Principle of Operation, Thermodynamic Analysis of A Stage, Degree of Reaction –Velocity Diagram – Parson‟s Reaction Turbine – Condition for Maximum Efficiency.

UNIT- V

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, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants

JET PROPULSION: Principle of Operation – Classification of Jet Propulsive Engines – Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo Jet, Turbo Prop, Pulse Jet Engines – Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Apply the concepts and laws of thermodynamics to predict the operation of thermodynamic cycles and performance.	PO1,PO2,PO3
CO2	Analyze different types of boilers and drafts to compute their performance parameters.	PO1,PO2,PO3, PO4
CO3	Analyze the performance of steam nozzle and condenser, to calculate critical pressure ratio.	PO1,PO2, PO3,PO4
CO4	Evaluate the performance of steam turbines through velocity triangles.	PO1, PO2, PO3,PO4
CO5	Understand and analyze the different types of gas turbines and jet propulsions.	PO1,PO2,PO3

Text Books:

1. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013
2. Basic and Applied Thermodynamics, P.K. Nag, TMH , 2nd Edition,2012.

Reference Books:

1. Gas Turbines, V. Ganesan, TMH
2. Thermodynamics and Heat Engines, R.Yadav, Central Publishing House, Allahabad, 2002.
3. Thermal Engineering, Mahesh M Rathore, McGrawHill,2010
4. Thermal Engineering, R.S Khurmi & JS Gupta, S.Chand, 2012.
5. Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K International, 2007.
6. Steam Tables SI Units- Dr.B.Umamaheswar Gowd and A. Nagraju, Siri Publ.

NOTE: Steam tables and Mollier charts to be supplied for exam.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2									
CO2	2	2	2	1								
CO3	3	2	2	1								
CO4	3	2	2	1								
CO5	3	1	1									
Average	**2.8**	**2**	**1.8**	**1**								

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B.Tech - V Semester (ME) **L T P C**

(18PC0313) FLUID MECHANICS & HYDRAULIC MACHINERY **2 1 0 3**

Course Objectives:

This course offers basic knowledge on fluid statics, dynamics and hydraulic machines. The objective of this course is to enable the student to understand laws of fluid mechanics and evaluate pressure, velocity and acceleration fields for various fluid flows and performance parameters for hydraulic machinery.

UNIT - I

FLUID STATICS : Dimensions and units: physical properties of fluids – specific gravity, porosity surface tension – vapor pressure and their influence on fluid motion – atmospheric gauge and vacuum pressure – measurement of pressure – Piezometer, U-tube differential manometers.

FLUID KINEMATICS : stream line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow.

Fluid dynamics: surface and body forces – Euler‟s and Bernoulli‟s equations for flowing stream line, momentum equation and its application on force on pipe bend.

UNIT – II

CONDUIT FLOW: Reynold‟s experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pitot tube, venturimeter and orifice meter, Flow nozzle and Turbine current meter.

UNIT – III

TURBO MACHINERY : hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done efficiency, flow over radial vanes.

HYDROELECTRIC POWER STATIONS: Elements of hydro electric power stationtypes-concept of pumped storage plants-storage requirements.

UNIT – IV

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.

PERFORMANCE OF HYDRAULIC TURBINES : Unit and specific quantities, characteristics, governing of turbines, selection of type of turbine, cavitation and surge tank.

UNIT – V

CENTRIFUGAL PUMPS : Classification- working-work done – manomertic head – loss efficiencies – specific speed – pumps in series and parallel – performance characteristic curves and NPSH.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Apply mathematical knowledge to predict the properties and characteristics of a fluid, analysis of pressure measurements and concept of fluid flows.	PO1, PO2, PO3, PO4
CO2	Demonstrate knowledge and understanding the basic equations of fluid flows, compute drag and lift coefficients and solve problems in flow of fluids	PO1, PO2, PO3, PO4
CO3	Analyze the model and the prototype using dimensional analysis.	PO1, PO2, PO3, PO4
CO4	Design the working proportions of hydraulic turbines and analysis to improve the performances.	PO1, PO2, PO3, PO4
CO5	Analyze to improve the performance of pumps and ability to engage in independent.	PO1, PO2, PO3, PO4

TEXT BOOKS :

1. Fluid Mechanics, Hydraulic and Hydraulic Machines by Modi & Seth, Standard book house.
2. A Text of Fluid Mechanics and Hydraulic Machines by Dr.R.K.Bansal – Laxmi Publications (P) Ltd., New Delhi.
3. Mechanics of Fluids by Potter, Wiggert, Ramadan, M.M.M.SARCAR, Cengage Publishers.

REFERENCE BOOKS :

1. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age International.
2. Principles of Fluid Mechanics and Fluid Machines by M.Narayana Pillai, Universities Press.
3. Fluid mechanics and fluid machines by Rajput, S.Chand & Co.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	3								
CO2	2	2	2	1								
CO3	3	2	2	1								
CO4	3	2	2	1								
CO5	3	1	1	1								
Average	**2.8**	**2**	**1.8**	**1.4**								

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B.Tech - V Semester (ME) **L T P C**

(18PC0314) MACHINE TOOLS **3 0 0 3**

Course Objectives:

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

UNIT- I

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry of single point tool and 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, heat generation, tool life, coolants, machinability – economics of machining. cutting Tool materials and cutting fluids –types and characteristics .

UNIT- II

Engine lathe – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread turning and attachments for Lathes.Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

UNIT- III

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring tools – machining time calculation.
Shaping, Slotting and Planning machines –Principles of working – Principal parts – specification, classification, Operations performed. Machining time calculations

UNIT- IV

Milling machine – Principles of working – specifications – classifications of milling machines – Principal features – machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to milling machines. Grinding machine –Theory of grinding – classification– cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines –
Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel. Static and dynamic balancing of a wheel Truing and Dressing of wheels. Lapping, Honing and Broaching machines – comparison of grinding, lapping and honing. machining time calculations.

UNIT- V

Principles of design of Jigs and fixtures and uses, 3-2-1 Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices, Typical examples of jigs and fixtures Unit built machine tools – multispindle heads. power units-principal of working types of UBMTS, characterization, applications

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the theory of metal cutting, tool life and geometry of single point cutting tool.	PO1,PO2,PO3
CO2	Understand the basic principle of lathe and identify various cutting tools used for different operations.	PO1,PO3
CO3	Select suitable reciprocating machines for typical component.	PO1,PO2,PO3
CO4	Understand the principle of milling, grinding, Lapping, Honing and Broaching operation and necessary tools.	PO1,PO3
CO5	Design jigs for drilling and fixtures for turning, milling	PO1,PO2

Text Books:

1. Workshop Technology – Vol II, B.S.RaghuVamshi, Dhanpat Rai & Co, 10th edition, 2013
2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition, 2012

Reference Books:

1. Manufacturing Technology-Kalpakzian- Pearson
2. Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2nd edition, 2012
3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st edition, 2001
4. Production Technology by K.L.Narayana, IK International Pub.
5. Machining and machine tools by AB. Chattopadyay, WileyEdn,2013
6. Unconventional Machining process by V.K.Jain, Allied Pub.
7. Manufacturing technology Vol II by P.N. Rao, Tata McGraw Hill, 4th edition, 2013
8. Machine Technology Machine tools and operations by Halmi A Yousuf&Harson, CRC Press Taylor and Francies .

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2									
CO2	2		2									
CO3	3		2									
CO4	3	2	2									
CO5	3	1										
Average	**2.8**	**2**	**2**									

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B.Tech V Semester (ME) **L T P C**

18M00113 Management Science **3 0 0 3**
(Open Elective-I)

Course Objectives:
The objective of the course is to equip the student the fundamental knowledge of management science and its application for effective management of human resource, materials and operation of an organization. It also aims to expose the students about the latest and contemporary developments in the field of management.

UNIT – I
Introduction to Management: Concept-Nature and Importance of Management, Functions-Evaluation of Scientific Management, Modern management-Motivation Theories-Leadership Styles-Decision MakingProcess-Designing Organization StructurePrinciples and Types of Organization.

UNIT - II
Operations Management: Plant location and Layout, Methods of production, WorkStudy-Statistical Quality Control through Control Charts, Objectives of Inventory Management, Need for Inventory Control-EOQ&ABC Analysis(Simple Problems)Marketing Management: Meaning,Nature, Functions of Marketing, Marketing Mix, Channels of distributionAdvertisement and sales promotion-Marketing strategies-Product Life Cycle.

UNIT – III
Human Resource Management(HRM): Significant and Basic functions of HRMHuman Resource Planning(HRP), Job evaluation, Recruitment and Selection, Placement and Induction-Wage and Salary administration. Employee Training and development-Methods-Performance Appraisal-Employee Grievances-techniques of handling Grievances.

UNIT – IV
Strategic Management: Vision, Mission, Goals and Strategy- Corporate Planning Process-Environmental Scanning-SWOT analysis-Different Steps in Strateg Formulation, Implementation and Evaluation. Project Management: Network AnalysisPERT, CPM, Identifying Critical Path-Probability-Project Cost Analysis, Project Crashing (Simple Problems).

UNIT - V
Contemporary Management Practices: Basic concepts of MIS-Materials Requirement Planning(MRP),Just-In-Time(JIT)System, Total Quality Management(TQM)-Six Sigma and Capability Maturity Models(CMM) evies, Supply Chain Management, Enterprise Resource Planning(ERP),Performance Management, Business Process Outsourcing(BPO), Business Process Re-Engineering and Bench Marking, Balance Score Card. Learning Outcome: This course enables the student to know the principles and applications of management knowledge and exposure to the latest developments in the field. This helps to take effective and efficient management decisions on physical and human resources of an organization. Beside the knowledge of Management Science facilitates for his/her personal and professional development.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Able to apply the concepts & principles of management in real life industry	PO1,PO2,PO3
CO2	Able to maintain Materials departments, & Determine EOQ	PO1,PO3
CO3	Able to apply the concepts of HRM in Recruitment, Selection, Training & Development .	PO1,PO2,PO3
CO4	Able to develop PERT/CPM Charts for projects of an enterprise and estimate time & cost of project.	PO1,PO3
CO5	Able to understand & apply modern management techniques MIS, ERP, MRP, TQM, CMM, SCM, BPO, BPR, Bench Marking and Balance Score Card wherever possible.	PO1,PO2

TEXT BOOKS:

1. A.R Aryasri: Management Science, TMH, 2013
2. Kumar /Rao/Chalill „Introduction to Management Science" Cengage, Delhi, 2012.

REFERENCE BOOKS:

1. A.K.Gupta "Engineering Management",S.CHAND, New Delhi, 2016.
2. Stoner, Freeman, Gilbert, Management, Pearson Education,New Delhi, 2012.
3. Kotler Philip & Keller Kevin Lane: Marketing Mangement , PHI,2013.
4. Koontz & Weihrich: Essentials of Management, 6/e, TMH, 2005.
5. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
6. Memoria & S.V.Gauker, Personnel Management, Himalaya, 25/e, 2005
7. Parnell: Strategic Management, Biztantra, 2003. 9. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2005.

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2									
CO2	2		2									
CO3	3		2									
CO4	3	2	2									
CO5	3	1										
Average	**2.8**	**2**	**2**									

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B.Tech V Semester (ME) **L T P C**

(18OE0301) Industrial Engineering **3 0 0 3**
(Open Elective-I)

Course Objectives:

1. To learn the concepts of management and characteristics of personnel Management.
2. To understand the organizational structures and plant layout for productivity improvements
3. To know the basic need of work study, method study, time study and industrial psychology.
4. To learn the Forecasting, Process planning and control of manufacturing a product
5. To study the inventory control and personnel management in an industry.

UNIT - I

Concepts of Management-Administration and Organization – Functions of Management – Schools of Management Thought: Taylor‟s Scientific Management, Fayol‟s Principles of Management, Douglas Mc-Gregor‟s Theory X and Y, Mayo's Hawthorne Experiments, Hertzberg‟s Two factor Theory of Motivation, Maslow‟s Hierarchy of Human needs – Systems Approach to Management.Organizational Structures- Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and their Merits, Demerits and Suitability

UNIT - II

Plant Location: Definition, Factors affecting the Plant Location, Comparison of Rural and Urban sites, Selection of Plant Location – Types of Production; Plant Layout: Definition, Objectives, Types of Plant Layout - Materials Handling: Functions- Objectives – Types, Selection Criteria of Material Handling Equipment.

UNIT - III

Work Study – Definition, Objectives, Method Study – Steps Involved – Various Types of Process Charts –Micro motion and Memo motion Studies. Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps Involved, Standard Time Calculations - Applications.

UNIT - IV

Inventory Models- Deterministic models- EOQ Models – With and Without Shortages Models; Inventory Models with Price Breaks -Probabilistic Models –Discrete Variable, Continuous Variable. Inventory Control Systems

UNIT - V

Inspection & Quality Control: Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves. Introduction to TQM-Quality circles-BIS & ISO Standards-Importance.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the concepts of management and characteristics of Administration and organization	**PO1,PO11, PO12**
CO2	Explain the organizational structures and plant layout for productivity Improvements	**PO1,PO11, PO12**
CO3	Describe the basic need of work study, method study, time study and industrial psychology	**PO1,PO11, PO12**
CO4	Explain the Forecasting, Process planning and control of manufacturing a product	**PO1,PO11, PO12**
CO5	Demonstrate the inventory control and personnel management in an industry	**PO1,PO11, PO12**

Text Books:

1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004
2. Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.
3. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International Publishers, 1st edition, 2011.

Reference Books:

1. Industrial Engineering and production management, MartindTelsang S.Chand..
2. Work Study by ILO(International Labour Organization)
3. Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2005
4. Production and Operations management, PanneerSelvam, PHI,2004.
5. Statistical Quality Control by EL Grantt, McGrawhil
6. Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2										1	1
CO2	2										1	1
CO3	2										1	1
CO4	2										1	1
CO5	2										1	1
Average	**2**										**1**	**1**

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B.Tech V Semester (ME) **L T P C**

(18OE0302) PRODUCT DESIGN **3 0 0 3**

(Open Elective-I)

Course Objective:

To make the students understand the product development process, requirements setting, conception design,, embodiment design principles, to understand the basics of mechatronics and adaptronics.

UNIT - I

PRODUCT DEVELOPMENT PROCESS

General problem solving process - Flow of Work during the process of designing - Activity Planning Timing and scheduling, Planning Project and Product Costs – Effective Organization Structures - Interdisciplinary Cooperation, Leadership and Team behavior.

UNIT - II

TASK CLARIFICATION

Importance of Task Clarification - Setting up a requirements list - Contents, Format, Identifying the requirements, refining and Extending the requirements, Compiling the requirements list, Examples. Using requirements lists - Updating, Partial requirements lists, Further uses - Practical applications of requirements lists.

UNIT - III

CONCEPTUAL DESIGN

Steps in Conceptual Design. Abstracting to identify the essential problems - Aim of Abstraction, Broadening the problem. Formulation, Identifying the essential problems from the requirements list,

Establishing functions structures, Overall function, Breaking a function down into subfunctions.

Developing working structures - Searching for working principles, Combining Working Principles, Selecting Working Structures, Practical Application of working structures. Developing Concepts - Firming up into principle solution variants, Evaluating principle solution variants, Practical Applications of working structures. Examples of Conceptual Design - One Handed Household Water Mixing Tap, Impulse - Loading Test Rig.

UNIT - IV

EMBODIMENT DESIGN - Steps of Embodiment Design, Checklist for Embodiment Design Basic rules of Embodiment Design Principles of Embodiment Design - Principles of Force Transformations, Principles of Division of Tasks, Principles of Self- Help, Principles of Stability and Bi-Stability, Principles of Fault-Free Design Guide for Embodiment Design - General Considerations, Design to allow for expansion, Design to allow for creep and relaxation, Design against Corrosion, Design to minimize

wear, Design to Ergonomics, Design for Aesthetics, Design for Production, Design for Assembly, Design for Maintenance, Design for Recycling, Design for Minimum risk, Design to standards. Evaluation of Embodiment Designs.

UNIT - V

MECHANICAL CONNECTIONS, MECHATRONICS AND ADAPTRONICS

Mechanical Connections - General functions and General Behavior, Material connections, From Connections, Force connections, Applications. Mechatronics - General Architecture and Terminology, Goals and Limitations, Development of Mechatronic Solution, Examples. Adaptronics - Fundamentals and Terminology, Goals and Limitations, Development of Adaptronics Solutions, Examples.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Use the Product Design and Development Process, as a means to manage the development of an idea from concept through to production.	**PO1,PO11, PO12**
CO2	Employ research and analysis methodologies as it pertains to the product design process, meaning, and user experience.	**PO1,PO11, PO12**
CO3	Apply creative process techniques in synthesizing information, problem-solving and critical thinking.	**PO1,PO11, PO12**
CO4	Demonstrate and employ hand drawing and drafting principles to convey concepts.	**PO1,PO11, PO12**
CO5	Use basic fabrication methods to build prototype models for hard-goods and soft-goods and packaging.	**PO1,PO11, PO12**

Text Books:

1. Engineering Design: G.Paul; W. Beitzetal, Springer International Education 2010.
2. Product Design And Developement: Kevin Otto: K. Wood Pearson Education 2016.

Reference Books:

1. Product Planning Essentials: Kenith B. Kahu, Yes dee Publishing 2011.

2. Product Design and Development: K.T. Ulrich TMH Publishers 2011.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2										1	1
CO2	2										1	1
CO3	2										1	1
CO4	2										1	1
CO5	2										1	1
Average	**2**										**1**	**1**

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B.Tech - V Semester (ME) **L T P C**

(18PC0315) FLUID MECHANICS & HYDRAULIC MACHINERY LAB **0 0 3 1.5**

Course Objectives:

The objective of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

SYLLABUS :

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Varification of Bernoulli‟s equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

LIST OF EQUIPMENT :

1. Venturimeter Setup.
2. Orifice meter setup.
3. Small orifice setup.
4. External mouthpiece setup.
5. Rectangular and Triangular notch setups.
6. Friction factor test setup.
7. Bernoulli‟s theorem setup.
8. Impact of jets.
9. Hydraulic jump test setup.
10. Pelton wheel and Francis turbines.
11. Centrifugal pumps.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate the knowledge on properties of fluids and fluid flow characteristics of various hydraulic machines.	PO1
CO2	Measure and analyze the flow parameters using orifice, mouth piece and notches also Analyze the performance of centrifugal, reciprocating pumps and also ability to engage in independent	PO2
CO3	Determine and design the pipe flow by considering various loss of energy	PO3
CO4	Understand working, performance of hydraulic turbine by conduct investigation.	PO4
CO5	Follow the ethical principles while doing the experiments	PO8
CO6	Do the experiments effectively as an individual and as a team member in a group.	PO9
CO7	Communicate verbally and in written form pertaining to results of the experiments	PO10
CO8	Continue updating their skills related to fluid mechanics and hydraulic machines in future.	PO12

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3											
CO2		3										
CO3			3									
CO4				3								
CO5								3				
CO6									2			
CO7										2		
CO8												2
average	**3**	**3**	**3**	**3**				**3**	**2**	**2**		**2**

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B.Tech - V Semester (ME) **L T P C**

(18PC0316) MACHINE TOOLS LAB **0 0 3 1.5**

Course Objectives:

The students are required to understand the parts of various machine tools and operate them. They are required to understand the different shapes of products that can be produced on these machine tools.

LIST OF EXPERIMENTS

1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping and Planning
6. Job on Slotting
7. Job on Milling (groove cutting/ gear cutting)
8. Job on Cylindrical and Surface Grinding
9. Job on Grinding of Tool angles.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Knowledge in general purpose machines: Lathe, drilling machine, milling machine, shaper, planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.	**PO1**
CO2	Analyze problems and offer a Qualitative assessment on problem solutions	**PO2**
CO3	Design the model and develop the parts	**PO3**
CO4	Identify different manufacturing techniques to produce complex shapes	**PO4**
CO5	Manufacture simple parts using lathe/milling drilling/shaper and alignment are verified by standard metrology instruments	**PO5**
CO6	Follow the ethical principles in conducting the experiments	**PO8**
CO7	Perform Experiments individually and also a team to complete the work	**PO9**
CO8	Communicate in verbally or in written form their understanding about the experiments	**PO10**
CO9	Continue updating their skill related to Machine Tools for various applications during their life time	**PO12**

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3											
CO2		3										
CO3			3									
CO4				3								
CO5								3				
CO6									2			
CO7										2		
CO8												2
average	**3**	**3**	**3**	**3**				**3**	**2**	**2**		**2**

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B.Tech - VI Semester (ME) **L T P C**

(18PC0317) HEAT TRANSFER **2 1 0 3**

Course Objectives:

The students will gain the ability to get an in-depth understanding of the principles governing the transfer of heat, the techniques , tools and skills required to solve typical thermal related problems, the analysis of energy flows in complicated systems and the design of efficient heat transfer equipments. Enables the student to utilize analogies to solve heat transfer problems. Further students gain hands-on experience in heat transfer experimentation through a number of laboratory tests.

UNIT - I

Introduction: Modes and Mechanisms of Heat Transfer – Basic Laws of Heat Transfer – General Applications of Heat Transfer.

Conduction Heat Transfer: Fourier Rate Equation – General Heat Conduction Equation In Cartesian, Cylindrical and Spherical Coordinates.

Simplification and Forms of the Field Equation – Steady, Unsteady and Periodic Heat Transfer – Boundary and Initial Conditions.

One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres – Overall Heat Transfer Coefficient – Electrical Analogy – Critical Radius/Thickness of Insulation – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation

UNIT – II

Heat Transfer in Extended Surface (Fins) – efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement.

One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance – Significance of Biot and Fourier Numbers – Chart Solutions of Transient Conduction Systems – Problems on Semi-infinite Body.

UNIT - III

Convective Heat Transfer: Dimensional Analysis – Buckingham Π Theorem and Its Application for Developing Semi – Empirical Non-Dimensional Correlations for Convective Heat Transfer – Significance of Non-Dimensional Numbers – Concepts of Continuity, Momentum And Energy Equations.

Forced Convection: External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over – Flat Plates, Cylinders and Spheres.

Internal Flows: Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow, Annular Flow.

Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate – Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

UNIT - IV

Heat Transfer with Phase Change:

Boiling: Pool Boiling – Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.

Condensation: Filmwise and Dropwise Condensation – Nusselt‟s Theory of Condensation on a Vertical Plate – Film Condensation on Vertical snd Horizontal Cylinders Using Empirical Correlations.

Heat Exchangers: Classification of Heat Exchangers – Overall Heat Transfer Coefficient and Fouling Factor – Concepts of LMTD and NTU Methods – Problems using LMTD and NTU Methods.

UNIT - V

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation – Irradiation – Total and Monochromatic Quantities– Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann – Heat Exchange Between Two Black Bodies – Concepts of Shape Factor – Emissivity – Heat Exchange Between Gray Bodies – Radiation Shields – Electrical Analogy for Radiation Networks.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Understand and analyze the basics of heat transfer and steady state and unsteady state conduction	**PO1,PO2,PO3,PO4**
CO2	Formulate practical transient conduction heat transfer problems by transforming the physical system into a Mathematical model and selecting an appropriate solution.	**PO1,PO2,PO3,PO4**
CO3	Understand the convective heat transfer systems with types	**PO1,PO2,PO3,PO4**
CO4	Illustrate the basic knowledge on phase change heat transfer and heat exchangers	**PO1,PO2,PO3,PO4**
CO5	Demonstrate the transfer of heat on radiation	**PO1,PO2,PO3,PO4**

Text Books:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International, 2010.

Reference Books:

1. Heat Transfer, P.K.Nag, 3/e, TMH, 2011
2. Heat Transfer, S.P.Sukhatme, University Press, 4th edition, 2005
3. Heat Transfer, Holman.J.P, 10/e, TMH, 2012

NOTE: Heat transfer Data books are permitted for Exam.

Suggestion:

1. Student is advised to visit heat transfer laboratory to understand the concept of three modes of heat transfer.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	1	1								
CO2	3	3	1	1								
CO3	2	3	1	1								
CO4	3	3	1	1								
CO5	2	3	1	1								
Average	**2.6**	**3**	**1**	**1**								

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B.Tech - VI Semester (ME) **L T P C**

(18PC0318) CAD/CAM **3 0 0 3**

Course Objectives:

The objective of the this subject is to enable the students to understand and handle design problems in symmetric manner, gain practical experience in handling 2-D drafting and 3-D modeling software systems, apply CAD in real life applications, understand the concepts G and M codes and manual part programming and know the applications of CNC machines. Further the students will become familiar on principles of computer graphics, geometric modeling, NC and CNC machines, group technology and FMS.

UNIT - I

Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD standards, CAD data structure, Data base management systems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, homogeneous transformations, clipping, hidden line / surface removal colour, shading.

UNIT - II

Geometric Modeling: Representation techniques, Parametric and non parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations. Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry, analytical solid modeling.

UNIT - III

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining centre, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Codes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

UNIT - IV

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non optical, integration of CAQC with CAD and CIM.

UNIT - V

Computer Aided Processes Planning: Retrieval type and Generative type, benefits, Machinability data systems, Computer generated time standards.

Computer integrated production planning: Capacity planning, shop floor control, MRP-I, MRP-II, CIMS benefits. Trends in Manufacturing systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to Cos**
CO1	Gained knowledge about the basic fundamental of CAD and computer graphics	**PO1,PO2,PO3,PO5**
CO2	Acquire knowledge on Requirements of geometric modeling and design different models using methodologies'.	**PO1,PO2,PO3,PO5**
CO3	Know the basics of computerized numerical programming by using modern tools.	**PO1,PO2,PO3,PO5**
CO4	Obtain the concepts, applications and components of Computer integrated manufacturing	**PO1,PO2,PO3,PO5**
CO5	Understand the computers in process planning and Quality Control.	**PO1,PO2,PO3,PO5**

Text Books:

1. CAD/CAM, A Zimmers&P.Groover, PE, PHI
2. CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition, 2010

Reference Books:

1.Computer Aided Design & Manufacturing, Lalit Narayan/Mallikarjuna Rao/M.M.M.Sarcar.PHI(2015)
2.Automation, Production systems & Computer integrated Manufacturing ,Groover, P.E
3. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age, 3rd edition, 2008

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	1	1		1							
CO2	3	1	1		1							
CO3	3	1	1		1							
CO4	3	1	1		1							
CO5	3	1	1		1							
Average	**3**	**1**	**1**		**1**							

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B.Tech V1 Semester (ME) **L T P C**

(18PE0301) Design of Transmission Elements **3 0 0 3**

(Professional Core Elective-I)

Course Objectives:

To aware the student about basic concepts of curved beams with different cross sections, design of power transmission elements, understand the design concepts of various types of springs, various types of bearings and gears.

To know the students how to apply design concepts in designing of IC engine parts like Piston, cylinder, connecting rod and crank shaft.

UNIT - I

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

DESIGN OF POWER TRANSMISSIONS SYSTEMS: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

UNIT - II

DESIGN OF MECHANICAL SPRINGS: Stress and deflections of helical Springs- Springs for fatigue loading – Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs- Design of leaf springs.

DESIGN OF POWER SCREWS: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screwpossible failures

UNIT - III

DESIGN OF BEARINGS: Types of Journal bearings – Lubrication – bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings.

UNIT - IV

DESIGN OF SPUR & HELICAL GEARS: Spur gears- Helical gears – Bending strength – Design analysis of spur and Helical gears – Estimation of centre distance, module and face width. Check for dynamic and wear considerations.

UNIT - V

DESIGN OF IC ENGINE PARTS: Pistons– Design of piston. Cylinder, Connecting Rod. Crank shafts- Center and over hung cranks.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Design of mechanical components such as power screws and drives	**PO1, PO2, PO3, PO4**
CO2	Design and analyze the energy storing elements of springs and flywheel	**PO1, PO2, PO3, PO4**
CO3	Know the procedure of designing the sliding contact bearings and rolling contact bearings	**PO1, PO2, PO3, PO4**
CO4	Gained the knowledge in the design of gears	**PO1, PO2, PO3, PO4**
CO5	Design and analyze the parts in the internal combustion engines	**PO1, PO2, PO3, PO4**

Text Books:

1. MechanicalEngineeringDesign,JosephE.Shigely,TMH Publishers,NewDelhi, 9th edition, 2010.
2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.

Reference Books:

1. MachineDesign,Schaum'sseries,TMHPublishers, NewDelhi, 1st edition, 2011
2. Design ofMachine Elements, V.B.Bhandari , TMH Publishers,NewDelhi, 2nd edition, 2013.

NOTE: Design data books are permitted in the examinations.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	3	2	2								
CO3	3	3	2	2								
CO4	3	3	2	2								
CO5	3	3	2	2								
Average	**3**	**3**	**2**	**2**								

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B.Tech V1 Semester (ME) **L T P C**

(18PE0302) Flexible Manufacturing Systems **3 0 0 3**

(Professional Core Elective-I)

UNIT- I

Introduction to flexible manufacturing systems. Planning and scheduling and control of FMS. Knowledge based scheduling. The Development of Manufacturing systems. Pallets, Fixtures and Machines, work handling system layouts.

UNIT – II

Hierarchy of computer control. Supervisory computer. System Management, Tool Management, Simulation and Analysis in the Design of FMS.

UNIT – III

Software for simulation and database of FMS. Specification and selection, trends, application of simulation software. Simulation Modeling for FMS.

UNIT – IV

Manufacturing data systems data flow, CAD/CAM considerations. Planning FMS database, just in time characteristics, Pull method, quality small lot sizes, work station loads, close supplier ties, flexible workforce — line flow strategy. Simulation for FMS Design.

UNIT – V

Preventive maintenance. Karban system, implementation issues. Economic justification of FMS; Artificial Intelligence in the Design of FMS.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Apply the concepts of PPC and GT to the development of FMS.	**PO1, PO2, PO3, PO4**
CO2	Discuss the planning and scheduling methods used in manufacturing systems.	**PO1, PO2, PO3, PO4**
CO3	Identify various workstations, system support equipments.	**PO1, PO2, PO3, PO4**
CO4	Identify hardware and software components of FMS.	**PO1, PO2, PO3, PO4**
CO5	Summarize the concepts of modern manufacturing such as JIT, supply chain management and lean manufacturing etc.	**PO1, PO2, PO3, PO4**

Text Books:

1. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age, 3rd edition, 2008
2. CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition, 2010

References:

1. Joseph Talavage, Roger G. Hannam " Flexible Manufacturing systems in Practice (Applications, Design and simulation)" CRC Press
2. Hand Book of Flexible Manufacturing Systems/ Jha N K/ Academic Press.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	3	2	2								
CO3	3	3	2	2								
CO4	3	3	2	2								
CO5	3	3	2	2								
Average	**3**	**3**	**2**	**2**								

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B.Tech V1 Semester (ME) **L T P C**

(18PE0303) GEOMETRIC MODELING **3 0 0 3**

(Professional Core Elective-I)

UNIT- I

Introduction, Application area of Computer graphics, overview of graphic system, video-display devices, raster- scan systems, random scan systems, graphics monitors and work stations and input devices.

Output primitives: Points and lines, line drawing algorithms, midpoint circle algorithm, Filled area primitives: scan-line polygon fill algorithm, boundary-fill and flood –fill algorithm.

UNIT- II

2-D geometrical transformations : Translation, scaling, rotation, reflection and shear transformation matrix representations and homogeneous co-ordinates, composite transformations, transformations between coordinates.

2-D viewing: The viewing pipe0line,viewing coordinat4 reference frame, window to view – port-co-ordinate transformations, viewing function, Cohen-Sutherland and Cyrus – beck line clipping algorithms, Sutherland-Hodgeman polygon clipping algorithm.

UNIT- III

3-D object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B- spline curve, Bezier and B- spline surfaces, Basic illumination models, shading algorithms.

3-D geometric transformations: Translation, rotation, scaling, reflection and shear transformation and composite transformations.

UNIT- IV

Visible surface detection methods: Classification, back-face detection, depth- buffer, scan-line, depth sorting.

UNIT- V

Computer animation : Design of animation sequence, general computer animation functions, raster animation. Computer animation language, key frame system, motion specification.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Define the coordinate system for the development of geometric models.	**PO1, PO2, PO3, PO4**
CO2	Develop and manipulate the curves and surfaces using parametric equations.	**PO1, PO2, PO3, PO4**
CO3	Develop and manipulate the solid models using different modeling approaches.	**PO1, PO2, PO3, PO4**
CO4	Implement the transformation and projection over the geometric model.	**PO1, PO2, PO3, PO4**
CO5	Implement the neutral file formats over 2D wireframe models.	**PO1, PO2, PO3, PO4**

TEXT BOOKS:

1. Mathematical Elememts for computer graphics,David 1 Rodgers,TMH
2. —Computer Graphics and Automation, M.C. Trivedi, Jaico Pub. Pearson Education

REFERENCES:

1. CAD/CAM Theory , Ibrahim Zeid,TMH
2. Computer Graphics second edition, Zhigand xiang,Roy Plastock, Schaum's outlines, Tata Mc-Graw Hill edition.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	3	2	2								
CO3	3	3	2	2								
CO4	3	3	2	2								
CO5	3	3	2	2								
Average	**3**	**3**	**2**	**2**								

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B.Tech V1 Semester (ME) **L T P C**

(18PE0304) AUTOMOBILE ENGINEERING **3 0 0 3**

(Professional Core Elective-II)

Course Objectives:

The students acquires sufficient knowledge to classify Engines, Chassis, Fuel Supply Systems, Cooling Methods, Lubrication Methods, Ignition Systems, Generating Systems, Suspension Systems, transmission system, steering mechanism and braking methods. The students get the working knowledge of assembly of various components of layout and of various electrical equipment of an automobile.

UNIT- I

Introduction: Components of a Four Wheeler Automobile – Chassis and Body – Power Unit – Power Transmission – Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive – Types of Automobile Engines, Engine Construction, Turbo Charging and Super Charging – Oil Filters, Oil Pumps – Crank Case Ventilation.

UNIT- II

Transmission System: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel – Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter. Propeller Shaft – Hotch – Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles.

UNIT- III

Steering System: Steering Geometry – Camber, Castor, King Pin Rake, Combined Angle Toe-In, Center Point Steering. Types Of Steering Mechanism – Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears – Types, Steering Linkages.

UNIT- IV

Suspension System: Objects of Suspension Systems – Rigid Axle Suspension System, Torsion Bar, Shock Absorber, Independent Suspension System. Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

UNIT- V

Emissions from Automobiles – Pollution Standards National and International – Pollution Control– Techniques – Multipoint Fuel Injection for SI Engines- Common Rail Diesel Injection, Emissions from Alternative Energy Sources– Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits. Electrical System: Charging Circuit, Generator, Current – Voltage Regulator – Starting System, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Température Indicator.

Course Outcomes:

On successful completion of the course the student will be able to,		POs related to COs
CO1	Acquired knowledge on vehicle components and basic construction	PO1, PO4
CO2	Synthesized the principles of transmission system in automobile, and identify the trouble shooting problems in transmission	PO1, PO2, PO3
CO3	Identified the steering system, wheel alignment and trouble shooting.	PO1, PO2 PO4,
CO4	Understand the functioning of suspension and braking system, identified the new technologies of braking system	PO1, PO3, PO4,PO5
CO5	Understand the emissions from automobile and analyzed the engine management system	PO1, PO3,PO7,PO12

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers Distributors, 13th edition, 2013.
2. Automobile Engineering , William Crouse, TMH, 10th edition, 2006.

Reference Books:

1. Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.
2. Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition. 3. Automotive engines , Newton, Steeds & Garret.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3			2								
CO2	3	3		2								
CO3	3		2	2	3							
CO4	3		2	2	2							
CO5	3		2				2					2
Average	**3**	**3**	**2**	**2**	**2.5**		**2**					**2**

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B.Tech V1 Semester (ME) **L T P C**

(18PE0305) GAS TURBINES AND JET PROPULSION **3 0 0 3**

(Professional Core Elective-II)

Course Objectives:

To make the students understand the working principles of Gas Turbines and concepts of Jet Propulsions.

UNIT - I

Gas Turbine Operating Cycles: Simple open cycle gas turbine or air standard Brayton cycle, Actual Brayton cycle, the cycle air flow rate, the cycle work ratio, optimum pressure ratio or maximum cycle thermal efficiency, means of improving the efficiency and the specific out put of simple cycle.

UNIT – II

Gas Turbines; gas turbine applications, gas turbine advantages & disadvantages, energy flow & back work, deviation from ideal cycle, gas turbine with regeneration, thermal efficiency of gas turbine with & without regenerator, gas turbine engines, inter- cooling & reheating, turbojet engine, turbofan engine, turboprop engine.

UNIT – III

Jet propulsion: Historical sketch- reaction principle- essential features of propulsion devices- Thermal jet engines, classification of – energy flow, thrust, thrust power and propulsion efficiency- need for thermal jet engines and applications.

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

UNIT - IV

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

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

UNIT - V

Rocket Technology: Flight mechanics, application thrust profiles, acceleration- staging of rockets, need for – feed systems, injectors and expansion nozzles – rocket transfer and ablative cooling. Testing & instrumentation - need for Cryogenics – advanced propulsion systems, elementary treatment of Electrical nuclear and plasma Arc Propulsion.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the basic concepts of compressible flows and Isentropic flows	**PO1,PO2,PO3**
CO2	Summarize the variation of flow properties in constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow)	**PO1,PO2,PO3**
CO3	Derive the conditions for change in pressure, density and temperature for flows through normal and oblique shocks.	**PO1,PO2,PO4,PO5**
CO4	Understand the types, functions of jet propulsion	**PO1, PO2, PO3,PO5**
CO5	study the characteristics of rocket propulsion systems and space flights	**PO1, PO2, PO3,PO6**

TEXT BOOKS:

1. Gas Turbines , V. Ganesan TMGH
2. Gas turbines , cohen , Rogers & Sarvana Muttoo , Addision Wiley & longman

REFERENCES BOOK:

1. Thermodynamics of propulsion, Hill & Paterson.
2. Rocket Propulsion , Sutton.
3. Element of Gas Turbines propulsion , Jack D Matingly, MGH

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2		2								
CO2	3	2		2								
CO3	3	2		2	3							
CO4	3	**2**	2		2							
CO5	3	2	2			2						
Average	**3**	**2**	**2**	**2**	**2.5**	**2**						

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B.Tech V1 Semester (ME) **L T P C**

(18PE0306) METAL FORMING PROCESS **3 0 0 3**

(Professional Core Elective-II)

Course Objectives:

Metal forming processes are highly non linear because they involve geometric, material and contact non linearity. And so this subject introduce the concepts of one, two and three dimensional stress analysis, theory of plasticity, strain hardening, hot and cold working process. The students also will get the awareness on various types of rolling mills, forgings, extrusions, wire drawing processes, sheet metal operations, concepts on plastic manufacturing processes and rapid manufacturing process and its applications.

UNIT - I

Stress, strain, Two dimensional stress analysis and three dimensional stress analysis, relation between engineering stress and true stress, relation between engineering strain and true strain, yield criteria, yield locus, theory of plasticity, Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts

UNIT - II

ROLLING: Bulk deformation processes – Economics of bulk forming, principles and theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements, applications and, limitations, defects in rolled products – machinery and Equipment.

FORGING PROCESSES: Principles of forging –Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects, Forces in forging of strip, disc and power requirements, applications, Equipment and their selection.

UNIT - III

EXTRUSION PROCESSES: Basic extrusion process and its characteristics. Mechanics of hot and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion, forces in extrusion of cylindrical and non cylindrical components – characteristics and defects in extruded parts.

Wire Drawing: Process Mechanics and its characteristics, determination of degree of drawing, drawing force, power, and number of stages-defects in products.

UNIT - IV

Sheet Metal Working – Economical Considerations - Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – Cup drawing and Tube drawing – coining – Hot and cold spinning. Force and power requirement in sheet metal operations, defects in sheet metal products – Equipment, tooling and their characteristics.

UNIT - V

Processing of plastics, injection and blow moulding, calendaring, thermo forming, compression moulding, transfer moulding, High energy rate forming methods Rapid manufacturing: - Introduction – concepts of rapid manufacturing, information flow for rapid prototyping, classification of rapid prototyping process, sterer holography fused deposition modeling, selective laser sintering, Applications of rapid prototyping process

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	To understand basic concept of one, two and three dimensional stress analysis and theory of plasticity, strain hardening, hot and cold working process.	**PO1,PO2,PO3**
CO2	To understand the principles of rolling and forging processes and their applications.	**PO1,PO2,PO3**
CO3	To understand fundamentals of extrusion process and wire drawing processes and their industrial applications.	**PO1,PO2,PO4,PO5**
CO4	To understand the various press working processes, their advantages and disadvantages.	**PO1, PO2, PO3,PO5**
CO5	To understand the concept of blow, injection process, rapid manufacturing process and its applications.	**PO1, PO2, PO3,PO6**

Text Books:

1. Manufacturing Technology, Schmid and kalpakjin, Pearson Education.
2. Manufacturing Technology, Foundry forming and welding, Vol I , P.N. Rao,TMH

Reference Books:

1. Production Technology, R.K. Jain, Khanna Publishers,17th edition, 2012
2. Process and materials of manufacturing –Lindberg, PE

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2		2								
CO2	3	2		2								
CO3	3	2		2	3							
CO4	3	**2**	2		2							
CO5	3	2	2			2						
Average	**3**	**2**	**2**	**2**	**2.5**	**2**						

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B.Tech V1 Semester (ME) **L T P C**

(18OE0303) OPERATIONS RESEARCH **3 0 0 3**

(Open Elective-II)

Course Objectives:

The subject should enable the students to the nature and scope of various decision making situations with in business contexts, understand and apply operation research techniques to industrial applications, To make the student capable of Formulating the various real life decision making problems as Mathematical programming problems. Students to learn the fundamental Techniques of Operations Research and to choose a suitable OR technique to solve problem on hand.

UNIT - I

Introduction to OR and Linear Programming-1 OR definition– Classification of Models – Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two– Phase Simplex Method, Big-M Method Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions;

UNIT - II

Linear programming-2: Duality- Principle, Economic Interpretation of Duality, Dual Simplex Method

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel‟s Approximation Method; OptimalityTesting. Special Cases -Unbalanced Transportation Problem, Degenerate Problem; Assignment Problem – Formulation; Optimal Solution -Traveling Salesman problem.

UNIT - III

Game Theory: Introduction – Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy –Games with Mixed Strategies– Dominance Principle–Graphical Method, Algebraic methods, sub matrices method. Queuing Theory: Introduction –Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern(Service Pattern), Queue Discipline, Birth & Death

Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non finite queue length.

UNIT - IV

Sequencing -Assumptions-n-jobs-2 Machines model, n-jobs-3-machines models & n jobs – m Machines models. PERT & CPM: Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA Diagram, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float CPM- Deterministic Model- Critical Path, Crashing, Optimal Project Duration, Least Possible Project Duration

PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time

UNIT - V

Dynamic Programming : Introduction – Bellman‟s Principle of Optimality – Applications of Dynamic Programming- Capital Budgeting Problem – Shortest Path Problem – Solution of

Linear Programming Problem by DP Replacement Models: Introduction –Types of Replacement Problem, Determination of
Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Select the constraints on the availability of resources, develop a model and render an optimal solution during the given circumstances.	**PO1,PO2,PO3**
CO2	Appraise the challenges in the transportation and assignment problems and furnish a rational solution to maximize the benefits.	**PO1,PO2,PO3**
CO3	Analyze the decision criteria's and strategies in game theory.	**PO1,PO2, PO3, PO11**
CO4	Construct the network diagram and estimate the time required to complete the project and determine optimum processing job order and investigate the nature of the project/ failure and offering methodical assistance towards sequencing.	**PO1,PO2,PO3**
CO5	Expand the basic knowledge on dynamic programming.	**PO1,PO2,PO3**

Text Books:

1. Operation Research, J.K.Sharma,MacMilan, 5th edition, 2013.
2. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.

Reference Books:

1. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers
2. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.
3. Operations Research, Wagner, PHI Publications , 2nd edition.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2									
CO2	3	3	2									
CO3	3	3	2								1	
CO4	3	3	2								1	
CO5	3	3	2								1	
Average	**3**	**3**	**2**								**1**	

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B.Tech V1 Semester (ME) **L T P C**

(18OE0304) TOTAL QUALITY MANAGEMENT **3 0 0 3**

(Open Elective-II)

Course Objectives:

To understand the concept of quality, cost of quality, international quality standards. To learn the principles of Total quality management, techniques for problem solving. To learn about various tools of quality management used in various industrial applications.

UNIT – I

TQM – overview , concepts, elements – History-Quality management philosophies- Juran, Deming, Crosby , Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – objectives – internal and external customers. Quality standards – Need of standardization - Institutions – bodies of standardization, ISO 9000 series – ISO 14000 series – other contemporary standards – ISO certification
process-Third party audit.

UNIT – II

Process management- Quality measurement systems (QMS) – developing and implementing QMS – nonconformance database- TQM tools & techniques- 7 QC tools- 7 New QC tools. Problem Solving techniques - Problem Solving process – corrective action – order of precedence

UNIT – III

System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis. Quality circles – organization – focus team approach – statistical process control – process chart – Ishikawa diagram – preparing and using control charts.

UNIT - IV

Quality Function Development (QFD) – elements of QFD – benchmarking-Types-Advantages & limitations of benchmarking – Taguchi Analysis – loss function – Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

UNIT – V

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management. Six sigma approach – application of six sigma approach to various industrial situations.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Describe the concepts of total quality management, and Contributions of TQM	**PO1,PO11, PO12**
CO2	Understand the TQM principles and impact of 5s,Kaizen, PDSA cycles in continuous process improvement.	**PO1,PO11, PO12**
CO3	Illustrate the basic need of quality control and process control in an organization	**PO1,PO2, PO11, PO12**
CO4	Summarize the traditional and modern TQM tools and techniques	**PO1,PO3, PO11, PO12**
CO5	Realize the quality standard, requirements and elements in Quality management system	**PO1,PO11, PO12**

TEXT BOOKS:

1. Total Quality Management, D.R.Kiran, BS Publications, 2016
2. Total Quality Management by Besterfield, Pearson.

REFERENCE BOOKS:

1. Quality management by Howard Giltow-TMH
2. Quality management by Evans.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3										1	2
CO2	3										1	2
CO3	3	2									1	2
CO4	3		1								1	2
CO5	3										1	2
Average	**3**	**2**	**1**								**1**	**2**

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B.Tech V1 Semester (ME) **L T P C**

(18OE0305) ENERGY MANAGEMENT **3 0 0 3**

(Open Elective-II)

Course Objectives:

To make the students understand managerial economics of energy projects, to study about decpreciation and cost analysis and methods of investment analysis. To understand the energy auditing concepts.

UNIT - I

ENGINEERING ECONOMICS:

Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest- Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

UNIT - II

DEPRECIATION & COST ANALYSIS:

Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation- Morality curves. Break even analysis and break even chart- Minimum cost analysis- Benefit cost analysis- Life cycle cost analysis.

UNIT - III

PROJECT MANAGEMENT:

Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.

ENERGY MANAGEMENT PROGRAMS:

Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

UNIT - IV

ENERGY AUDITING:

A definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

UNIT - V

ENERGY POLICY, SUPPLY, TRADE& PRICES:

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy,Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	To understand the importance of energy economics.	**PO1,PO11, PO12**
CO2	To learn the importance of depreciation and cost analysis.	**PO1,PO11, PO12**
CO3	To learn the methods of energy management and audits.	**PO1,PO2, PO11, PO12**
CO4	To inculcate knowledge and skills about assessing the energy efficiency of an entity/ establishment.	**PO1,PO3, PO11, PO12**
CO5	To understand the importance of Supply & policies.	**PO1,PO11, PO12**

TEXT BOOKS:

1. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.

2. Murphy W.R and Mckay G, Energy Management, Butterworths, London, 1982.

3. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3										1	2
CO2	3										1	2
CO3	3	2									1	2
CO4	3		1								1	2
CO5	3										1	2
Average	**3**	**2**	**1**								**1**	**2**

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B.Tech V1 Semester (ME) **L T P C**

18M00114 ENTREPRENEURSHIP **3 0 0 3**

(Open Elective-III)

Course Objectives:

1. To enable students understand the importance of innovation in business practices
2. To enable students to innovate new methods and practices in business using innovation approaches
3. To provide knowledge on raising finance for starting new business
4. To enable students to protect their innovation through patent and copyright
5. To motivate students to become successful entrepreneurs through constant innovation

UNIT -I

Introduction to Entrepreneurship Definition Types of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision process. Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creative problem solving, product planning and development process.

UNIT - II

The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan,financial plan and the organizational plan, Launching formalities.

UNIT - III

Financing and Managing the new venture, Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising.

UNIT - IV

New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits.Choosing location and layout, Issues related to Selection of layout.

UNIT – V

Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, Designing the work place, Inventory control, material handling and quality control.Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Global aspects of Enterprenership.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Demonstrate the principles of business innovation and entrepreneurship for establishing industrial ventures..	**PO9,PO11**
CO2	Apply the approaches to innovation for developing successful ventures	**PO9, PO11**
CO3	Develop a comprehensive and well planned acquisition of finance for a new venture	**PO9,PO10,PO11**
CO4	Exhibit entrepreneurial competencies and protect the innovations	**PO9,PO11**
CO5	Apply ethics in constructive innovation framework.	**PO8, PO11,PO12**

Text Books:

1Entrepreneurship, Robert Hisrich, & Michael Peters, TMH, 5th Edition
2. Entrepreneurship, Dollinger, Pearson, 4/e 2004.

REFERENCES:

1. Dynamics of Entrepreneurial Development and management, Vasant Desai, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, . Robert J.Calvin:, TMH, 2004.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1									1		1	2
CO2									1		1	2
CO3									1	2	1	2
CO4									1		1	2
CO5								2			1	2
Average								**2**	**1**	**2**	**1**	**2**

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B.Tech V1 Semester (ME) **L T P C**

(18PC0503) DATABASE MANAGEMENT SYSTEMS **3 0 0 3**

(Open Elective-III)

Course Objectives:

The objective of the course is to present an introduction to database management systems, with an Emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.

UNIT - I

The Worlds of Database Systems -The Evolution of Database Systems - Overview of a Database Management System.

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

UNIT - II

E/R Relationship model:

Elements of E/R Model – Design Principles – The Modeling of Constraints – Weak Entity Sets.

The Relational Data Model – Basics of the Relational Model – From E/R Diagrams to Relational Designs – Converting Subclass Structures to Relations.

Relational database design: Domain and data dependency, Normal forms, Dependency preservation, Lossless design.

UNIT - III

The Database Language SQL – Simple Queries in SQL – Queries Involving More than One Relation – Subqueries – Full Relation Operations – Database Modifications – Defining a Relation Schema in SQL – View Definitions Transactions in SQL – Serializability, Atomicity, Transactions, Read only Transactions, Dirty Reads, Other isolation level

UNIT - IV

Representing Data Elements – Data Elements and Fields – Records – Representing Block and Record Addresses – Variable Length Data and Records – Record Modifications.

Index Structures – Indexes on Sequential Files – Secondary Indexes – B-Trees – Hash Tables.

UNIT - V

Coping with System Failures – Issues and Models for Resilient Operation – Undo Logging – Redo Logging – Undo/Redo Logging – Protecting Against Media Failures.

Concurrency Control – Serial and Serializable Schedules – Conflict Serializability – Enforcing Serializability by Locks – Locking Systems with Several Lock Modes -- Concurrency Control by Timestamps – Concurrency Control by Validation.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the basic concepts of relational data model, entity-relationship model, relational Database design, relational algebra and SQL.	**PO9,PO11**
CO2	Design ER-models to represent simple database application scenarios	**PO9, PO11**
CO3	Convert the ER-model to relational tables, populate relational database and formulate SQL Queries on data.	**PO9,PO10,PO11**
CO4	Improve the database design by normalization.	**PO9,PO11**
CO5	Familiar with basic database storage structures and access techniques: file and page Organizations, indexing methods including B tree, and hashing.	**PO8, PO11,PO12**

Text Books:

1. Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F.Kort h, S. Sudarshan, McGraw-Hill.

2. Data base Management Systems‖, Raghu Rama Krishnan, Johannes Gehrke, McGraw Hill, 3rd Edition.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1									1		1	2
CO2									1		1	2
CO3									1	2	1	2
CO4									1		1	2
CO5								2			1	2
Average								**2**	**1**	**2**	**1**	**2**

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B.Tech V1 Semester (ME) **L T P C**

(18OE0306) ALTERNATIVE SOURCES OF ENERGY **3 0 0 3**

(Open Elective-III)

Course Objectives:

To create awareness to the student about basic concepts of non-conventional source of energy, to understand the process of collection, storage, conversion and applications of Solar Energy, Wind Energy, Bio Mass, OTEC. To learn about direct conversion methods.

UNIT – I

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solarenergy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrialand terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

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 andstratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

UNIT - IV

BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gasyield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential inIndia.

UNIT - V

OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidaland wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, and principles of DEC.

Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD

accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic

aspects. Fuel cells, principles, faraday‟s law‟s, thermodynamic aspects, selection of fuels and operating conditions.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the current energy scenario in terms of conventional renewable energy and future plan	**PO1,PO2, PO6, PO12**
CO2	Describe the types solar thermal collectors and solar energy sources for electricity generation	**PO1,PO2,PO6, PO7, PO12**
CO3	Understand the functions of wind turbine and Ocean Thermal Energy conversion process	**PO1,PO6,PO7, PO12**
CO4	Illustrate the bio-energy for electricity generation and advancement in geothermal Energy	**PO1, PO6, PO7, PO12**
CO5	Demonstrate the various new and alternative sources such as MHD Power and fuel cells	**PO1, PO7, PO12**

TEXT BOOKS:

1. Non-Conventional Energy Sources /G.D. Rai
2. Energy Resources Utilization and Technologies, Anjaneyulu Yerramilli, Francis Tuluri, BS Publications, 2012

REFERENCES :

1. Renewable Energy Sources/ Twidell & Weir
2. Non Conventional Energy Resources, B.H.Khan, McGrawHIll, 2015

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2				2						1
CO2	3	2				2	2					1
CO3	3					2	2					1
CO4	3					2	2					1
CO5	3						2					1
Average	**3**	**2**				**2**	**2**					**1**

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B.Tech - VI Semester (ME) **L T P C**

(18PC0319) HEAT TRANSFER LAB **0 0 3 1.5**

Out comes:

Students would be able to perform experiments on heat conduction, convection and radiation. They will be able to identify the heat exchange properties of various metals.

LIST OF EXPERIMENTS

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Overall heat transfer co-efficient through Composite Slab Apparatus
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection
9. Experiment on Parallel and counter flow heat exchanger.
10. Emissivity of a gray body through Emissivity apparatus.
11. Experiment on Stefan Boltzman Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

Note: Any 10 of the above 15 experiments are to be conducted.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Demonstrate the knowledge on conduction, convection and radiation.	**PO1**
CO2	Identify and analyse various performance parameters of conduction, convection and radiation equipments.	**PO2**
CO3	Develop systems to identify the performance parameters of various heat transfer mechanisms.	**PO3**
CO4	Conduct investigation on performance of heat conduction, composite walls, transient heat flow, critical heat flux, forced and natural convection, emissivity and radiation.	**PO4**
CO5	Measure the values of conductivity, heat transfer co-efficient, effectiveness, Stephen-Boltzman constant by using modern tools like sensors.	**PO5**
CO6	Follow ethical principle in conduction of experiments.	**PO8**

CO7	Perform individually and also in a team to complete the process	**PO9**
CO8	Communicate in verbally or in written form, their understanding about the experiments.	**PO10**
CO9	Continue updating their knowledge on various testing methods in future, for the identification of performance parameters of heat transfer equipments.	**PO12**

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3											
CO2		3										
CO3			3									
CO4				3								
CO5								3				
CO6									2			
CO7										2		
CO8												2
average	**3**	**3**	**3**	**3**				**3**	**2**	**2**		**2**

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B.Tech - VI Semester (ME) **L T P C**

(18PC0320) CAD/CAM LAB **0 0 3 1.5**

Out comes:

Students would be able to development of part drawings for various components in the form of orthographic and isometric. Determination of deflection and stresses in 2D and 3D diagrams

LIST OF EXPERIMENTS

I. 2D Drafting using Auto CAD or any drafting package
II. 3D Modeling :
1. Modeling of Component in 3D – V block
2. Modeling of Component in 3D – Open Bearing
3. Modeling of Component in 3D – Angular block
4. Modeling of Component in 3D – Dovetail Guide
5. Modeling of Component in 3D – Dovetail Bracket
6. Modeling of Component in 3D – Tool post

Geometric Modeling may be done Using Auto CAD or Pro-E or CATIA or Solid Works or Iron CAD

III. Assembly Modeling:
1. Assembly of a screw jack parts
2. Assembly of a knuckle joint
3. Assembly of a Oldham‟s coupling
4. Assembly of a footstep bearing
5. Assembly of a stuffing box
6. Assembly of a square tool post

IV. Machining of Simple Components on CNC Lathe and CNC Milling Machine.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Apply the knowledge of engineering fundamentals to Understand the role of design of the mechanical engineering Components.	PO1
CO2	Analyze the components as per the drawing standard	PO2
CO3	Design and Development of mechanical part drawing and Assembly of components implemented in real time applications.	PO3
CO4	Apply appropriate techniques, resources use to Create Mechanical Components 3D modeling by modern engineering software tools.	PO5
CO5	Follow the ethical principles while creating the 2D, 3D modeling	PO8
CO6	Draw effectively as an individual drawing practice in laboratory.	PO9

CO7	Communicate verbally and in written form about the drawing procedure.	PO10
CO8	Continue updating their skill related to drawing and modeling of the components in future.	PO12

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3											
CO2		3										
CO3			3									
CO4				3								
CO5								3				
CO6									2			
CO7										2		
CO8												2
average	**3**	**3**	**3**	**3**				**3**	**2**	**2**		**2**

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B.Tech - VII Semester (ME) **L T P C**

(18PC0321) METROLOGY & MEASUREMENTS **3 0 0 3**

Course Objectives:

To introduce techniques and instrumentation used in mechanical measurement and Metrology.

UNIT - I

Limits, Fits and Tolernces : Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard system – International Standard organization system for plain work.

Limit Gauges and Gauge Design: Plug, Ring, Snap, Gap, Taper gauges. Taylor‟s principle. Design of Go and No Go gauges.

Comparators: Principle of Measurement with Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

UNIT - II

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

MEASUREMENT OF ANGLES AND TAPERS: Different methods – Bevel protractor – angle gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

Flatness Measurement: Measurement of flatness of surfaces – straight edges– surface plates – optical flat and auto collimators, interferometer and their uses.

UNIT - III

Surface Roughness Measurement: Differences between surface roughness and surfacewaviness- Numerical assessment of surface finish – CLA, R.M.S Values – Ra , Rz values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish.

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

Gear Measurement: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.

Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling and drilling machine tools. Preparation of acceptance charts.

UNIT - IV

Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

Measurement of Speed: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer .

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

Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

UNIT - V

Measurment of Temperature: Standards and calibration, thermal expansion methods, thermo electric sensors(thermocouples), Electrical Resistance sensors, Junction semiconductor sensors, Digital thermometers, Radiation methods.

Measurement of Pressure and Sound: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, Elastic transducers, vibrating cylinder, resonant transducers, High and low pressure measurement, sound measurement.

Measurement of Force, Torque, Power: Standards and calibration, Basic methods of Force Measurement, Torque measurement on rotating shafts, shaft power measurement(dynamometers), Vibrating wire force transducers.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Understand the importance of measurements in engineering and the factors affecting measurements and to estimate measurement uncertainty and its knowledge using lifelong.	**PO1, PO2, PO5, PO12**
CO2	Apply the working principle and applications of various linear and angular measuring instruments and basic concepts of comparators uncertainty and its knowledge using lifelong.	**PO1, PO5, PO12**
CO3	Apply the principles and methods of form measurements and surface metrology	**PO1, PO5**
CO4	Apply the advances in measurements for quality control in	**PO1, PO2, PO5**

	manufacturing industries.	
CO5	Understand various measuring techniques of mechanical parameters in industrial applications.	**PO1, PO2, PO5**

Text Books:

(1) Mechanical Measurements ,Beckwith, Marangoni, Linehard, PHI, PE

(2) Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH,2012.

(3) Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013.

Reference Books:

(1) Engineering Metrology, Mahajan, DhanpatRai, 2nd edition, 2013.

(2) BIS standards on Limits & Fits

(3) Fundamentals of Dimensional Metrology,Connie Dn ,CENGAGE LEARNERS

(4) Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, Mc GrawHill, 2013.

(5) Instrumentation, measurement &analysis ,B.C.Nakra&KKChoudhary, TMH, 6th edition, 2011.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2			1							1
CO2	2				1							1
CO3	2				2							
CO4	3	2			2							
CO5	3	2			2							
Average	**2.6**	**2**			**1.6**							**1**

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B.Tech V11 Semester (ME) **L T P C**

(18OE0307) COMPOSITE MATERIALS **3 0 0 3**

(Open Elective-IV)

Course Objectives:

1. To know the fundamentals of composite, lamina constitutive equations and manufacturing
2. To learn the flat plate laminate constitute equations
3. To study the lamina strength analysis of flat plates
4. To drive the modification of Laminate Constitutive Equations for thermal analysis.
5. To understand the analysis of laminated flat plates.

UNIT - I

Introduction to Composite Materials: Introduction, Classification: Polymer Matrix Composites. Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber. Reinforced Composites and nature-made composites, and applications

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide. fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites.

UNIT - II

Manufacturing methods: Autoclave curing, tape production, moulding methods, filament winding, hand layup, pultrusion, RTM. Compression moulding, tape winding.

Macromechanical Analysis of a Lamina: Introduction ,Definitions: Stress, Strain ,Elastic Moduli, Strain Energy. Hooke‟s Law for Different Types of Materials, Plane Stress Assumption, Reduction of Hooke‟s Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT - III

Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi Empirical Models ,Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion

UNIT - IV

Macromechanical Analysis of Laminates: Introduction, Laminate Code, Stress– Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate , Hygrothermal Effects in a Laminate, Warpage of Laminates

UNIT - V

Failure Analysis and Design of Laminates: Introduction, Special Cases of Laminates, Failure Criterion for a Laminate.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the fundamentals of composite, lamina constitutive equations and manufacturing	**PO1,PO2,PO3**
CO2	Demonstrate the flat plate laminate constitute equations	**PO1,PO2,PO3**
CO3	Understand the lamina strength analysis of flat plates	**PO1,PO2,PO3**
CO4	Drive the modification of Laminate Constitutive Equations for thermal analysis.	**PO1,PO2,PO3**
CO5	Analysis of laminated flat plates for natural and free vibrations.	**PO1,PO2,PO3**

Text Books:

1. Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford University Press, 1994.
2. Mechanics of Composite Materials, R. M. Jones, Mc Graw Hill Company, New York, 1975.

References:

1. Analysis and performance of fibre Composites, B. D. Agarwal and L. J. Broutman Wiley-Interscience, New York, 1980.
2. Mechanics of Composite Materials, Second Edition (Mechanical Engineering)- Autar K. Kaw, Publisher: CRC
3. Finite Element Analysis of Composite Materials, Ever J. Barbero , CRC Press, 2007.
4. Analysis of Laminated Composite Structures, L. R. Calcote, Van Nostrand Rainfold, New York, 1969.
5. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay, University Press, 2009.
6. Composite Materials Science and Engineering, Krishan K. Chawla, Springer, 2009

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2									
CO2	3	2	2									
CO3	3	2	2									
CO4	3	2	2									
CO5	3	2	2									
Average	**3**	**2**	**2**									

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B.Tech V11 Semester (ME) **L T P C**

(18OE0308) INTELLECTUAL PROPERTY RIGHTS **3 0 0 3**

(Open Elective-IV)

Course Objectives:

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

UNIT – I

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.

Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.

Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V

New Developments Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits. International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Intellectual Property Rights and what they mean	**PO1,PO2,PO3**
CO2	Trade Marks and Patents and how to register them	**PO1,PO2,PO3**
CO3	Laws Protecting the Trade Marks and Patents	**PO1,PO2,PO3**
CO4	Copy Right and laws related to it.	**PO1,PO2,PO3**
CO5	Analysis of New Developments Of Intellectual Property	**PO1,PO2,PO3**

TEXT BOOKS & REFERENCES:

1. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learing.
2. Intellectual Property Rights– Unleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2									
CO2	3	2	2									
CO3	3	2	2									
CO4	3	2	2									
CO5	3	2	2									
Average	**3**	**2**	**2**									

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B.Tech V11 Semester (ME) **L T P C**

(18OE0309) DESIGN OF HEAT TRANSFER EQUIPMENT **3 0 0 3**

(Open Elective-IV)

Course Objectives:

1. To understand the fundamental principles of heat exchanger and classifications.
2. To analyze heat exchanger correlations and overall heat transfer coefficient of heat exchanger
3. To learn thermal and stress analysis on various parts of the heat exchangers.
4. To study the design of condenser, surface and evaporative condensers.

UNIT - I

Thermal performance analysis of heat exchangers - compact, cross flow, liquid to gas, and double pipe heat exchangers, film coefficients for tubes and annuli, equivalent diameter of annuli, fouling factors, caloric or average fluid temperature, true temperature difference; Design calculation of double pipe heat exchanger, double pipe exchangers in series-parallel arrangements.

UNIT - II

Shell and tube heat exchangers - tube layouts, baffle spacing, classification of shell and tube exchangers, Design calculation of shell and tube heat exchangers, shell-side film coefficients, shell-side equivalent diameter, true temperature difference in a 1-2 heat exchanger, influence of approach temperature on correction factor, shell and tube sides pressure drop; performance analysis of 1-2 heat exchangers, design calculation of shell and tube heat exchangers; flow arrangements for increased heat recovery.

UNIT - III

Direct contact heat transfer - Classification of cooling towers, wet-bulb and dew point temperatures, Lewis number, cooling-tower internals, heat balance, heat transfer by simultaneous diffusion and convection; Design and analysis of cooling towers, determination of the number of diffusion units, performance evaluation of cooling towers, influence of process conditions and operating variables on their design .

UNIT - IV

Heat pipes - types and applications, operating principles, working fluids, wick structures, control techniques, pressure balance, maximum capillary pressure, liquid and vapor pressure drops, effective thermal conductivity of wick structures, capillary limitation on heat transport capability, sonic, entrainment, and boiling limitations, determination of operating conditions;

UNIT - V

Heat pipe design – fluid selection, wick selection, material selection, preliminary design considerations, heat pipe design procedure, determination of heat pipe diameter, design of heat pipe containers, wick design, entertainment and boiling limitations, design problems; Non conventional heat pipes – flat, rotating, reciprocating and disc shaped heat pipes, heat pipes in cooling microelectronics – micro and mini heat pipes.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the fundamental principles of heat exchanger and classifications	**PO1, PO2, PO3, PO4**
CO2	Analyze heat exchanger correlations and overall heat transfer coefficient of heat exchanger	**PO1, PO2, PO3, PO4**
CO3	Illustrate the thermal and stress analysis on various parts of the heat exchangers	**PO1, PO2, PO3, PO4**
CO4	Understand the design of condenser, surface and evaporative condensers	**PO1, PO2, PO3, PO4**
CO5	Understand the fundamental, physical and mathematical aspects of boiling and condensation.	**PO1, PO2, PO3, PO4**

Text Books:

1. Kern, D. Q., Process Heat Transfer, Tata McGraw-Hill, 2000.
2. Chi, S. W., Heat Pipe Theory and Practice- A Source Book, McGraw-Hill, 1976

References:

1. Fraas, A. P., Heat Exchanger Design, Second Edition, John Wiley & Sons, 1989
2. Dunn, P. D. and Reay, D. A., Heat Pipes, Fourth Edition, Pergamon Press, 1994

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	2								
CO2	3	3	3	2								
CO3	3	3	3	2								
CO4	3	3	3	2								
CO5	3	3	3	2								
Average	**3**	**3**	**3**	**2**								

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B.Tech V11 Semester (ME) **L T P C**

(18PE0307) AUTOMATION AND ROBOTICS **3 0 0 3**

(Professional Core Elective-III)

Course Objectives:

The subject should enable the students to understand the principles of automation, importance of automated flow lines and its types. To learn the concepts of Robotics, kinematics of robot, principles of robot drives and controls, sensors used in robots and programming methods.

UNIT- I

Introduction to Automation: Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation. Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT- II

Automated flow lines: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT- III

Introduction to Industrial Robotics: Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers. Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

UNIT- IV

Manipulator Kinematics: Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics. Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

UNIT- V

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Summarize the various fundamental and advanced concepts of automation in industry	**PO1, PO2**
CO2	Understand the line balancing and flow lines of robotics in automated industry	**PO1, PO2**
CO3	Demonstrate the basic concepts of drives, sensors used in robots	**PO1, PO2**
CO4	Compare and analyze the kinematics and dynamics of robots	**PO1, PO2**
CO5	Explain about robot programming and applications	**PO1, PO2, PO3,**

Text Books:

1. Automation , Production systems and CIM,M.P. Groover/Pearson Edu.
2. Industrial Robotics - M.P. Groover, TMH.

Reference Books:

1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering , Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – AshitaveGhosal,Oxford Press, 1/e, 2006
5. Robotics and Control , Mittal R K &Nagrath I J , TMH.
6. Introduction to Robotics – John J. Craig,PearsonEdu

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2										
CO2	3	2										
CO3	3	2										
CO4	3	2										
CO5	3	2	2	2	2							
Average	**3**	**2**	**2**	**2**	**2**							

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B.Tech V11 Semester (ME) **L T P C**

(18PE0308) Computational Fluid Dynamics **3 0 0 3**

(Professional Core Elective-III)

Course Objectives:

This course covers topics related to Computational Fluid Dynamics (CFD). CFD is an important tool in engineering analysis and design of fluid systems. In this course Students will develop the equations describing fluid flow and numerical solutions to these equations. Emphasis will be placed on understanding different approaches employed for both time and spatial discretization and how to evaluate these approaches. Students will look at time accurate and steady-state methods, explicit and implicit techniques, laminar and turbulent flow, compressible and incompressible approaches, stability considerations, etc. These techniques will be applied to applications of mixing and heat transfer.

UNIT - I

INTRODUCTION: Methods to solve a physical problem , numerical methods , brief comparison between FDM, FEM & FVM, applied numerical methods. Solution of a system of simultaneous linear algebraic equations, Iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for baned matrices. Finite difference applications in heat conduction and convention, heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer.

UNIT - II

FINITE DIFFERENCES: Discretization, consistency, stability, and fundamentals of fluid flow modeling. Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT - III

ERRORS AND STABILITY ANALYSIS: Introduction, first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER: Introduction, Conservation of mass Newton‟s second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier stokes equations.

UNIT - IV

STEADY FLOW: Dimensions form of momentum and energy equations, navier stokes equation, and conservative body force fields, stream function, vorticity formulation, boundary, layer theory, buoyancy, driven convection and stability.

UNIT - V

SIMPLE CFD TECHNIQUES: Viscous flows conservation form space marching, relovation techniques, viscous flows, conservation from space marching relovation techniques, artificial viscosity, the alternating direction implicit techniques, pressure correction technique, computer graphic techniques used in CFD. Quasi one dimensional flow through a nozzle, turbulence models, standard and high reynolds number models and their applications.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Solve the Governing equation and boundary conditions of fluid dynamics	**PO1,PO2,PO3, PO4**
CO2	Derive and solve the finite difference equations of fluid dynamics	**PO1,PO2,PO3, PO4**
CO3	Formulate the Finite volume formulation for steady state one, two and three dimensional diffusion problems	**PO1,PO2,PO3, PO4**
CO4	Study the pressure-velocity corrections and equation of computational fluid dynamics	**PO1,PO2,PO3, PO4**
CO5	Learn the turbulence models and mesh generation	**PO1,PO2,PO3, PO4**

Text Books:

1. Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge University Press, India.

2. Computational Fluid Dynamics, John .D. Anderson (2010), 3rd edition, McGraw- Hill International Edition, India.

Reference Books:

1. Computational Fluid Mechanics and Heat Transfer, Ronnie Anderson, 3rd edition, CRC Press, Special Indian Edition.

2. Computational aerodynamics and fluid dynamics an introduction, JeanJacques Chattot (2010),3rd edition, Springer, Germany.

3. Essential computational fluid Dynamics – olegzikanov, wiley India.

4. Introduction to computational fluid dynamics – pradip, Niyogi S.K. Chakrabary, M.K. Laha – pearson.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2								
CO2	3	2	2	2								
CO3	3	2	2	2								
CO4	3	2	2	2								
CO5	3	2	2	2								
Average	**3**	**2**	**2**	**2**								

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B.Tech V11 Semester (ME) **L T P C**

(18PE0309) ADVANCED IC ENGINES **3 0 0 3**

(Professional Core Elective-III)

Course Objectives:

- To understand the underlying principles of operation of different IC Engines and components.
- To provide knowledge on pollutant formation, control, alternate fuel etc.

UNIT - I

SPARK IGNITION ENGINES: Air-fuel ratio requirements ,Design of carburetor –fuel jet size and venture size, Stages of combustion-normal and abnormal combustion, Factors affecting knock, Combustion chambers, Introduction to thermodynamic analysis of SI Engine combustion process.

UNIT - II

COMPRESSION IGNITION ENGINES: Stages of combustion-normal and abnormal combustion – Factors affecting knock, Direct and Indirect injection systems, Combustion chambers, Turbo charging , Introduction to Thermodynamic Analysis of CI Engine Combustion process.

UNIT - III

ENGINE EXHAUST EMISSION CONTROL: Formation of NOX , HC/CO mechanism , Smoke and Particulate emissions, Green House Effect , Methods of controlling emissions , Three way catalytic converter and Particulate Trap, Emission (HC,CO, NO and NOX ,) measuring equipments, Smoke and Particulate measurement, Indian Driving Cycles and emission norms

UNIT - IV

ALTERNATE FUELS: Alcohols, Vegetable oils and bio-diesel, Bio-gas, Natural Gas , Liquefied Petroleum Gas ,Hydrogen , Properties , Suitability, Engine Modifications, Performance , Combustion and Emission Characteristics of SI and CI Engines using these alternate fuels.

UNIT - V

RECENT TRENDS: Homogeneous Charge Compression Ignition Engine, Lean Burn Engine ,Stratified Charge Engine, Surface Ignition Engine , Four Valve and Overhead cam Engines, Electronic Engine Management, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine , Data Acquisition System –pressure pick up, charge amplifier PC for Combustion and Heat release analysis in Engines.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Describe the fuel injection systems and knock effect of Spark Ignition engine	**PO1,PO2, PO6**
CO2	Understand the fuel-injection system & turbo-charging of Compression Ignition engine	**PO1,PO6**
CO3	Illustrate the pollutant formation, measurements, Emission norms & control of pollution	**PO1,PO6,PO7**
CO4	Realize the suitability of alternate fuels and engine modification	**PO1, PO2,**

CO5	Summarize the latest advancement in automobile and hybrid vehicles	**PO1, PO2,PO3**

Text Books:

1. Heinz Heisler , 'Advanced Engine Technology," SAE International Publications ,USA,1998
2. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill ,2007

References:

1. John B Heywood," Internal Combustion Engine Fundamentals", Tata McGraw-Hill1988
2. Patterson D.J. and Henein N.A,"Emissions from combustion engines and their control," Ann Arbor Science publishers Inc, USA, 1978
3. Gupta H.N, "Fundamentals of Internal Combustion Engines" ,Prentice Hall of India, 2006
4. Ultrich Adler," Automotive Electric / Electronic Systems, Published by Robert Bosh GmbH,1995

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2				2						
CO2	3					2						
CO3	3					2	2					
CO4	3	2										
CO5	3	2	2									
Average	**3**	**2**	**2**			**2**	**2**					

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B.Tech V11 Semester (ME) **L T P C**

(18PE0310) FINITE ELEMENT METHODS **3 0 0 3**

(Professional Core Elective-IV)

Course objectives:

The subject should enable the students to learn the principles involved in discretization in finite element approach, form stiffness matrices and force vectors for simple elements, find the various approach followed in finite element approach, use the various elements for discretization and learn about shape functions. To learn the application of FEM to various structural problems incorporating temperature. and boundary conditions and heat transfer problems.

UNIT - I

INTRODUCTION: Equilibrium equations in elasticity subjected to body force, traction forces and point loads, stress strain relations in 3D elasticity, plane stress and plane strain, Boundary conditions, Initial conditions. Governing equation for Steady state heat conduction with convective boundary conditions. Approximate methods for solving the differential equations: Rayleigh-Ritz method, Weighted residual methods, Galerkin's method. Integral formulation: Principle of a minimum potential energy, principle of virtual work, Generalized Finite element approach in solving these problems. Solution methods for solving simultaneous equations.

UNIT - II

PROBLEMS WITH ONE-DIMENSIONAL GEOMETRY: Bars: Formulation of stiffness matrix, Load vectors, Incorporation of boundary conditions: Elimination approach and penalty approach. Trusses: Plane truss and space truss elements, Example problems involving plane truss elements. Examples involving multipoint constrains. Stress calculations. Beams & Frames: Bending of beams, Interpolation functions, formulation of stiffness matrix and load vectors. Plane frames, space frames. Transformations of stiffness and load vectors.

UNIT - III

INTERPOLATION MODELS: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal Triangle, Linear interpolation polynomials in terms of global coordinates for triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates for triangular (2D simplex) elements, quadrilateral element.

HIGHER ORDER AND ISOPARAMETRIC ELEMENTS: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element Tetrahedral and hexahedral elements.

UNIT - IV

FINITE ELEMENT APPLICATION IN SOLID MECHANICS: Problem modeling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Isoparametric, subparametric and superparametric elements. Interpolation, Jacobian, matrices relating strain and nodal displacements, stiffness matrix formulation, Consistent and lumped

load vectors, Numerical integration Gaussian quadrate. Axi-symmetric triangular elements: formulation of stiffness and load vectors. Introduction to 3D stress analysis.

UNIT - V

HEAT TRANSFER AND FLUID MECHANICS PROBLEMS: Steady state heat conduction with convective and heat flux boundary conditions, Functional approach, Galerkin approach formulation of element characteristic matrices and vectors in 1D and 2D problems. Temperature distribution in composite walls one dimensional and two dimensional fins and extended surfaces. Two dimensional potential flow problems: Potential function formulation and stream function formulation.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Understand the fundamental concepts behind variation methods	**PO1,PO2,PO3,PO4**
CO2	Analyze in one dimensional elements and trusses	**PO1,PO2,PO3,PO4**
CO3	Implement the formulation techniques to solve the Constant Strain Triangle element in two dimensional scalar problems	**PO1,PO2,PO3,PO4**
CO4	Formulate FE characteristic equations for two dimensional vector variable problems	**PO1,PO2,PO3,PO4**
CO5	Able to identify the isoparametric formulations and how the finite element method expands beyond the structural domain	**PO1,PO2,PO3,PO4**

Text Books:

1. Introduction to Finite Element in Engineering, TirupatiChandrapatla and Bellagundu , Pearson Education, New Delhi.
2. Finite Element Methods, S. S. Rao , Pergamom Press, New York

Reference Books:

1. Finite Element Method by R. Dhanaraj, K. Prabhakaran Nair Oxford University Press
2. Introduction to FEM, J. N. Reddy, TMH Publishers, New Delhi.
3. Finite Element Analysis, C.S. Krishna Moorthy, TMH Publishers, New Delhi.
4. Fundamentals of Finite Element Analysis, David V. Hutton , TMH Publishers, New Delhi.
5. Introduction to the Finite Element Methods, Desai and Abel , CBS Publishers, New Delhi.
6. Finite and Boundary Methods in Engineering, O.P.Gupta, Oxford and IBH Publishers, New Delhi.
7. Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	1								
CO2	3	3	2	1								
CO3	3	3	2	1								
CO4	3	3	2	1								
CO5	3	3	2	1								
Average	**3**	**3**	**2**	**1**								

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B.Tech V11 Semester (ME) **L T P C**

(18PE0311) TOOL DESIGN **3 0 0 3**

(Professional Core Elective-IV)

Course Objectives:

To make the students to understand the design of single point cutting tool. To learn about the design of drilling tool, tool wear Machinability index and tool life. To make the students to understand jigs and fixtures, design principle of jigs and fixtures, locating and clamping principles. To learn about the sheet metal operations, Design forming ,drawings ,Bending and drawing dies, forming dies. To make the students to understand plastics commonly used as tooling material.

UNIT - I

Tool materials: Ferrous, non ferrous, materials, heat treatment, plastics Classification of moulds used in processing of plastics, Design of injection, blow, and compression moulds.

UNIT - II

Design of single point cutting tools: Single point, cutting tools-various systems of specifications, geometry and their interrelation, theories of formation of chip and their effect.

UNIT - III

Design of multipoint cutting tools: Drill geometry, Design of Drills, Rake & Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speeds and feed-machining times-design-form cutters, combination tools, reamers etc.

UNIT - IV

Design of jigs and fixtures: Basic principles of location and clamping, locating, methods and devices, jigs, definitions, types, general consideration in the design of jigs, drills bushing, methods of construction, fixtures-vice fixtures milling, boring, and lathe grinding fixtures.

UNIT - V

Design of sheet metal blanking and piercing: Fundamentals of die cutting operating, power press- types, General press information, Material handling equipment, cutting action in punch and die operation. Die clearance, and types of Die construction. Die design fundamentals-blanking and piercing die construction, pilots, striper and pressure pads presswork material, strip layout. Design of sheet metal bending, forming and drawings die: Bending dies, drawing dies, forming dies, drawing operations, variables that effect metal flow during drawing. Determination of blank size, drawing force, single and double action draw dies.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe tool design methods and punch and die manufacturing techniques	**PO1,PO2,PO3,PO4**
CO2	Select material for cutting tools and gages; classify various cutting tools and gages and identify their nomenclature.	**PO1,PO2,PO3,PO4**
CO3	Describe the principles of clamping, drill jigs and computer aided jig design.	**PO1,PO2,PO3,PO4**
CO4	Design fixtures for milling, boring, lathe, grinding, welding; identify fixtures and cutting tools for NC machine tools.	**PO1,PO2,PO3,PO4**
CO5	Explain the principles of dies and moulds design.	**PO1,PO2,PO3,PO4**

Text Books:

1. Tool Design, Donaldson, Lecain and Goold, Tata McGraw Hill, 4th edition, 2012.
2. Principles of Metal cutting, A Bhattacharya, New Central Book Agency, Calcutta
3. ASTME Hand book on Tool Design.

Reference Books:

1. Production Engineering Design (Tool Design) , SurendraKenav and Umesh 'Chandra, Satyaprakashan, New Delhi 1994..
2. Design of cutting Tools. Use of Metal Cutting Theory. ASTME publication Michigan USA, 1969.Amitabha Battacharya

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	1								
CO2	3	3	2	1								
CO3	3	3	2	1								
CO4	3	3	2	1								
CO5	3	3	2	1								
Average	**3**	**3**	**2**	**1**								

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B.Tech V11 Semester (ME) **L T P C**

(18PE0312) Refrigeration & Air Conditioning **3 0 0 3**

(Professional Core Elective-IV)

Course Objectives:

This subject provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry. It gives details on how different components work and influence each other. Students will learn how real systems used in commercial , industrial refrigeration and air conditioning industries are built-up. The objective this subject is to make the student to have complete knowledge on various refrigeration methods like VCR, VAR and latest developments, knowledge on various air conditioning methods like summer, winter and year round air conditioning and to make the student to understand the practical applications of refrigeration and air conditioning systems.

UNIT - I

Introduction to Refrigeration: Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems -Numerical Problems – Refrigeration Needs of Air Crafts.

UNIT - II

Vapour Compression Refrigeration (VCR) System – Basic Cycle - Working Principle and Essential Components of The Plant – COP – Representation of Cycle On T-S and P-h Charts – Expander Vs. Throttling, Effect of Sub Cooling and Super Heating – Cycle Analysis – Actual Cycle- Influence of Various Parameters on System Performance – Construction and Use of P-h Charts – Numerical Problems. Refrigerants – Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

UNIT - III

Vapor Absorption Refrigeration (VAR) System – Description and Working of NH3 – Water System and Li Br –Water (Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System. Steam Jet Refrigeration System: Working Principle and Basic Components-Estimation of Motive Steam Required, Principle and Operation of: (I) Thermo-Electric Refrigerator (Ii) Vortex Tube OrHilsch Tube.

UNIT - IV

Introduction to Air Conditioning: Psychrometric Properties & Processes – Characterization of Sensible and Latent Heat Loads — Need For Ventilation, Consideration of Infiltrated Air – Heat Load Concepts. Air Conditioning Systems: Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

UNIT - V

Air Conditioning Equipment - Humidifiers – Dehumidifiers – Air Filters, Fans and Blowers. Human Comfort: Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart.Heat Pump – Heat Sources – Different Heat Pump Circuits.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Acquire knowledge to understand the principles and applications of refrigeration systems.	**PO1,PO2,PO3**
CO2	Know the working of vapour compression and vapour absorption refrigeration system and identify methods for performance improvement.	**PO1,PO2,PO3**
CO3	Understand the behavior of Refrigerants, functions of System Components, contextual knowledge to assess societal, health, safety and also understand the impact of the professional engineering solutions in societal and environmental contexts	**PO1,PO2,PO3,PO6, PO7**
CO4	Apply psychrometric charts, analyze the problems on psychrometry and acquire knowledge on air conditioning equipment's	**PO1,PO2,PO3**
CO5	Understand the air conditioning systems and cooling load estimation and also to engage in independent and life-long learning	**PO1,PO2,PO3, PO12**

Text Books:

1. Refrigeration and Air Conditioning ,CP Arora,TMH, 15th edition, 2013.
2. A Course in Refrigeration and Air conditioning,S.CArora&Domkundwar, Dhanpatrai

Reference Books:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2nd edition, 2013
2. Principles of Refrigeration - Dossat / Pearson Education, 4th edition, 2007.
3. Refrigeration and Air Conditioning-P.L.Ballaney, 2nd edition, 2012.
4. Basic Refrigeration and Air-Conditioning – P.N.Ananthanarayanan / TMH, 4th edition, 2013.

NOTE: Tables/Codes: Thermal Engineering Data Book containingRéfrigérant and Psychrometric property Tables and charts are permitted in Exam

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3									
CO2	3	3	3									
CO3	3	3	3			2	2					
CO4	3	3	3									
CO5	3	3	3									2
Average	**3**	**3**	**3**			**2**	**2**					**2**

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B.Tech - VII Semester (ME) **L T P C**

(18PC0322) METROLOGY & MEASUREMENTS LAB **0 0 3 1.5**

Out comes:

To create awareness on various mechanical measuring instruments and to understand calibration techniques of various measuring devices.

LIST OF EXPERIMENTS

Any 6 experiments from each section

Section A:

1. Measurement of bores by internal micrometers and dial bore indicators.
2. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
3. Alignment test on the lathe and milling machine
4. Study of Tool makers microscope and its application
5. Angle and taper measurements by Bevel protractor, Sine bars, spirit level etc.
6. Thread measurement by Two wire/ Three wire method.
7. Surface roughness measurement by Talysurf instrument.
8. Use of straight edge and sprit level in finding the flatness of surface plate.

Section B:

1. Calibration of Pressure Gauges
2. Calibration of transducer or thermocouple for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Study and calibration of capacitive transducer for angular measurement.
5. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
6. Study and calibration of a rotometer for flow measurement.
7. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
8. Study and calibration of Mcleod gauge for low pressure.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Develop the knowledge on measuring instruments such as vernier caliper, micrometer, sine bar, bevel protractor, autocollimator, etc.,	**PO1**
CO2	Analyze the instrumental error and calibration of the instruments.	**PO2**
CO3	Create complex analysis knowledge on measurements and alignment test on machines such as lathe, drilling, milling machines.	**PO4**
CO4	Use of Modern tools to measure the complex shape of the specimen such as gear tooth.	**PO5**
CO5	Follow ethical principle during usage of instruments.	**PO8**
CO6	Evaluate the value of measurements and compare with group members.	**PO9**
CO7	Communicate verbally and in written form of the understanding about the experiments.	**PO10**
CO8	Continue updating their measurement knowledge for various components and continue learning of new technology in metrology.	**PO12**

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3											
CO2		3										
CO3				3								
CO4					3							
CO5								3				
CO6									2			
CO7										2		
CO8												2
average	**3**	**3**		**3**	**3**			**3**	**2**	**2**		**2**

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B.Tech - VII Semester (ME) **L T P C**

(18PC0323) COMPUTER AIDED ENGINEERING LAB **0 0 3 1.5**

Out comes:

Student can able to simulate the given job by structural analysis and thermal analysis

LIST OF EXPERIMENTS

I. Introduction to Analysis Software Package

II. Structural analysis: (Any Six exercises)

1. Analysis of a rectangular plate with a hole.
2. Analysis of a truss member under loading.
3. Analysis of a bracket plate with axial loading
4. Analysis of a bracket plate with eccentric loading
5. Static Analysis of Prismatic bar
6. Static Analysis of a Corner Bracket
7. Static Analysis of beam
8. Analysis of Thermally Loaded support Structure
9. Analysis of Hinged support member
10. Analysis of Tapered plate under transverse load

III. Thermal analysis:(Any two exercises)

1. Analysis of a square plate considering conduction.
2. Analysis of a square plate considering conduction and convection.
3. Analysis of a compound bodies considering conduction and convection.

IV. Computational Fluid Dynamics (Any four exercises)

1. Determine the flow of incompressible gas through an S-bend for laminar flow.
2. Determine the flow of incompressible gas through an S-bend for turbulent flow.
3. Determine that of incompressible water flowing over a cylinder.
4. Determine air flow over a simple geometry (aerofoil) in a wind tunnel (2-D).
5. Determine heat transfer from the heated fin within a rectangular enclose containing air.
6. Determine how to solve a natural convection problem
7. Determine liquid enters through two inlets with different temperatures (multiphase flow) and leaves one outlet.

Software can be used: ANSYS, ALG Nastran, Star-CCM+, Fluent, FIRE. CFX.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Explain the practical experience in FEA software systems	**PO1**
CO2	Determine the deflection and stresses in 2D and 3D trusses and beams	**PO2**
CO3	Determine the thermo-mechanical stresses of a 3D component	**PO3**
CO4	Estimate the natural frequencies and mode shapes, harmonic response of 2D beam	PO4
CO5	write Part programming exercise on turning, milling, drilling	**PO5**
CO6	Follow the ethical principles while doing the experiments	**PO8**
CO7	Do the experiments effectively as an individual and as a team member in a group.	**PO9**
CO8	Communicate verbally and in written form pertaining to results of the experiments	**PO10**

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3											
CO2		3										
CO3			3									
CO4				3								
CO5					3							
CO6								3				
CO7									2			
CO8										2		
average	**3**	**3**		**3**	**3**			**3**	**2**	**2**		

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B.Tech V111 Semester (ME) **L T P C**

(18PE0313) Power Plant Engineering **3 0 0 3**

(Professional core Elective-V)

Course Objectives:

1. To understand the working principles of steam power plants and analyzes its performance.
2. To understand the working principles of diesel and gas turbine power plant
3. To explain the working of nuclear power plant and safety measures.
4. To know the working of hydroelectric power plant and other renewable energy sources
5. To learn the economics, Energy management and environmental issues of power generation.

UNIT – I:

Introduction to the Sources of Energy: Resources and Development of Power in India. **Steam Power Plant:** Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage and Ash handling systems.

Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT – II:

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

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

UNIT – III:

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

Hydro Projects and Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

Power From Non-Conventional Sources: Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy**.**

Direct Energy Conversion: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT-IV:

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT – V:

Power Plant Economics and Environmental Considerations: 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.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Know the working principles of steam power plants and analyzes its performance.	**PO1,PO2,PO3, PO6, PO7, PO12**
CO2	Explain the working of diesel and gas turbine power plant	**PO1,PO3, PO6, PO7, PO12**
CO3	Understand the working principles of nuclear power plant and safety measures	**PO1,PO2,PO3, PO6, PO7, PO12**
CO4	Explain the working of hydroelectric power plant and other renewable energy sources	**PO1,PO2,PO3, PO6, PO7, PO12**
CO5	Describe the economics, Energy management environmental issues of power generation	**PO1,PO2,PO3, PO6, PO7, PO12**

TEXT BOOKS:

1. A Course in Power Plant Engineering: / Arora and S. Domkundwar/ Dhanpat Rai Publisher
2. Power Plant Engineering / P.C.Sharma / S.K.Kataria Publisher
3. A Text Book of Power Plant Engineering / R.K.Rajput / Laxmi Publications

REFERENCES:

1. Power Plant Engineering/ P.K.Nag II Edition /TMH Publishers
2. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers
3. Power plant Engg /Elanchezhian/I.K. International Publishers

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2			1	1					1
CO2	3		2			1	1					1
CO3	3	2	1			1	1					1
CO4	3	2	1			1	1					1
CO5	3	2	1			1	3					2
Average	**3**	**2**	**1.4**			**1**	**1.4**					**1.5**

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B.Tech V111 Semester (ME) **L T P C**

(18PE0314) MECHATRONIC SYSTEMS **3 0 0 3**

(Professional core Elective-V)

Course Objectives:

To make the students to learn about the Basic electronics, electrical and mechanical components used to control the machines and industries. Various types of sensors, signal conditioning systems and various pneumatic and hydraulic components used in control systems. Micro controllers, PLCS and PLC program and programmable motion control systems.

UNIT - I

INTRODUCTION: Definition – Trends - Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

UNIT - II

SIGNAL CONDITIONING: Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering.

UNIT - III

PRECISION MECHANICAL SYSTEMS: Pneumatic Actuation Systems – Electropneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides – Linear Bearings - Bearings- Motor / Drive Selection.

UNIT - IV

ELECTRONIC INTERFACE SUBSYSTEMS: Motors Isolation schemes- opto coupling, buffer IC‟s - Protection schemes – circuit breakers, over current sensing, resettable fuses, Power Supply - Bipolar transistors/ mosfets.

ELECTROMECHANICAL DRIVES: Relays and Solenoids - Stepper Motors – DC brushed motors – DC brushless motors - DC servo motors - PWM‟s - Pulse Width Modulation – Variable Frequency Drives.

UNIT - V

MICROCONTROLLERS OVERVIEW: 8051 Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors – Applications, Programming –Assembly.

PROGRAMMABLE LOGIC CONTROLLERS: Basic Structure - Programming: Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling -Analog input / output - PLC Selection, interface – R232 etc.,- Applications.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the fundamentals of Mechatronics, Control Systems, Transducers and Sensors	**PO1,PO2**
CO2	Know the functions of Mechanical, Electrical, Hydraulic, Pneumatic Actuators in mechatronics systems	**PO1,PO2**
CO3	Demonstrate the Basic system models and Controller used in Mechatronic systems	**PO1, PO2, PO3**
CO4	Understand the applications of microprocessors and programmable logic controller in mechatronic system	**PO1, PO2, PO3, PO5**
CO5	study the Programmable Logic Controller and Mechatronic Systems	**PO1, PO2, PO3, PO5, PO12**

Text Books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics, M.D.Singh, J.G.Joshi, PHI.

Reference Books:

1.Mechatronics Principles, concepts and applications. Nitaigour premchand mahalik, MC Graw Hill Edu.
2. Mechatronics Source Book, Newton C Braga, Thomson Publications, Chennai.
3. Mechatronics, N. Shanmugam, Anuradha Agencies Publisers.
4. Mechatronics System Design, Devdas shetty,Richard,Thomson.

5. Mechatronics Er. R.K. Rajput. S. Chand Publications.

. **CO-PO Mapping**

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2										
CO2	3	2										
CO3	3	2	2									
CO4	3	2	2		2							
CO5	3	2	2		2							2
Average	**3**	**2**	**2**		**2**							**2**

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B.Tech V111 Semester (ME) **L T P C**

(18PE0315) MECHANICAL VIBRATIONS **3 0 0 3**

(Professional core Elective-V)

Course Objectives:

1. To understand the sources of vibration, Constructions of dampers and harmonic motion.
2. To study free vibration of single-degree of freedom systems in all kind of vibration systems
3. To determination of natural frequencies of vibrating system in forced vibration
4. To understand the different methods of controlling the vibration in the system.

UNIT - I

INTRODUCTION: Importance and scope ,definition and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

UNIT - II

SINGLE DEGREE FREEDOM SYSTEMS-I: Undamped free vibration: Classical method, Energy method, phase plane method, equivalent systems, torsional systems.

SINGLE DEGREE FREEDOM SYSTEMS-II: Damped free vibration: Viscous damping, under damping, critical damping, coulomb damping, equivalent damping coefficient

UNIT - III

SINGLE DEGREE FREEDOM SYSTEMS WITH FORCED VIBRATIONS: Steady state forced vibration, sources of excitation, impressed harmonic force, impressed force due to unbalance, motion

excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping, General theory of seismic instruments, accelerometer and vibrometer, methods of vibration control, excitation reduction at source, system modification.

UNIT - IV

TWO DEGREE FREEDOM SYSTEMS: Natural frequencies and modes of vibration by classical method of spring-mass system, forced vibration, dynamic vibration absorber

MULTI DEGREE FREEDOM SYSTEMS: Influence co-efficient method, damped mass and distributed mass systems, stodola method, Holzer's method, newtons iteration method, orthogonality of mode shapes.

UNIT - V

VIBRATION IN CINTINUOUS SYSTEMS: Longitudinal vibration of bars, torsional vibrations of circular rods or shafts, lateral vibrations of beams and shafts.

Whirling of shafts critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping.

Course Outcomes:

completion of the course, Students will be able to		**POs related to COs**
CO1	Know the sources of vibration, Constructions of dampers and harmonic motion.	**PO1,PO2,PO3,PO 4**
CO2	Examine the free vibration of single-degree of freedom systems	**PO1,PO2,PO3,PO 4**
CO3	Determination of natural frequencies of vibrating system in forced vibration	**PO1,PO2,PO3,PO 4**
CO4	Understand the different methods of controlling the vibration in the system.	**PO1,PO2,PO3,PO 4**
CO5	Measure and monitor the frequency and vibration exciters measurements	**PO1,PO2,PO3,PO 4**

Text Books:

1. Mechanical Vibrations, G.K.Grover
2. Theory and practice of mechanical Vibrations, J.S.Rao and K.Gupta

Reference Books:

1. Vibration Theory and Applications, W.T.Thomson
2. Vibration problems in Engineering,Timeoshenko and Young

. **CO-PO Mapping**

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2								
CO2	3	2	2	2								
CO3	3	2	2	2								
CO4	3	2	2	2								
CO5	3	2	2	2								
Average	**3**	**2**	**2**	**2**								

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B.Tech V111 Semester (ME) **L T P C**

(18PE0316) Additive Manufacturing (Professional core Elective-VI) **3 0 0 3**

Course Objectives:

1. To understand the need and development of additive manufacturing technology.
2. To learn the design for additive manufacturing, CAD modeling and printing process.
3. To know the parameters and process of liquid and solid based additive manufacturing processes
4. To explain the powder based additive manufacturing process and material jetting
5. To demonstrate the post processing techniques and applications of AM process

UNIT - I

Introduction: Need for the compression in product development, History of RP system,Survey of applications, Growth of RP industry and classification of RP system.

Stereo Lithography System: Principle, Process parameter, Process details, Data preparation, Data files and machine details, Applications.

UNIT - II

Fusion Decomposition Modeling: Principle, process parameter, Path generation, Applications. **Solid ground curing:** Principle of operation, Machine details, Applications,

Laminated Object Manufacturing: Principle of Operation, LOM materials, Process details, Applications.

UNIT – III

Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer, GenisysXs printer HP system 5, Object Quadra system.

UNIT – IV

LASER ENGINEERING NET SHAPING (LENS)

Rapid Tooling: Indirect Rapid tooling- Silicon rubber tooling- Aluminum filled epoxy tooling Spray metal tooling, Cast kriksite, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.

Software for RP: STL files, Overview of Solid view, magics, imics, magic communication, etc. Internet based software, Collaboration tools.

UNIT - V

Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data preparation error, Part building error, Error in finishing, Influence of build orientation.

Allied Process: Vacuum casting, surface digitizing, Surface generation from point cloud, Surface modification- Data transfer to solid models.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the need and development of additive manufacturing technology	**PO1, PO2**
CO2	Explain the design for additive manufacturing, CAD modeling, printing process	**PO1, PO2, PO3**
CO3	Illustrate the process of liquid and solid based additive manufacturing processes	**PO1, PO2, PO3**
CO4	Explain the powder based additive manufacturing process and material jetting	**PO1, PO2, PO3**
CO5	Summarize the post processing techniques and applications of AM process	**PO1, PO2, PO3**

TEXT BOOKS:

1. " stereo lithography and other RP & M Technologies**"**, Paul F.Jacobs, SME, NY 1996
2. " Rapid Manufacturing **",** Flham D.T &Dinjoy S.S, Verlog London 2001
"Rapid automated**"**, Lament wood, Indus Press New York.

. **CO-PO Mapping**

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2										
CO2	3	2	1									
CO3	3	2	1									
CO4	3	2	1									
CO5	3	2	1									
Average	**3**	**2**	**1**									

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B.Tech V111 Semester (ME) **L T P C**

(18PE0317) MODERN MANUFACTURING METHODS **3 0 0 3**

(Professional core Elective-VI)

Course Objectives:

1. To understand the working principles of mechanical energy based machining process.
2. To learn electric discharge machining and wire cut EDM process for machining
3. To understand the working of Laser beam and Electron machining process.
4. To know the chemical based and electro chemical based machining process.
5. To learn advanced finishing processes and recent developments in the non- traditional machining.

UNIT - I

Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications. Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

UNIT - II

Ultrasonic machining: Elements of the process, mechanics of material removal, process parameters, applications and limitations. Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

UNIT - III

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM. Chemical Machining: Fundamentals of chemical machining- Principle of material removal- maskants – etchants- process variables, advantages and applications.

UNIT - IV

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy - Applications of different processes and their limitations. Plasma Machining: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

UNIT - V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations. Laser Beam Machining: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Understand the working principles of mechanical energy based machining process	**PO1,PO2**
CO2	Explain electric discharge machining and wire cut EDM process for machining	**PO1,PO2**
CO3	Understand the working of Laser beam and Electron machining process	**PO1,PO2**
CO4	Explain the chemical based and electro chemical based machining process.	**PO1,PO2**
CO5	Summarize the advanced surface finishing processes and recent developments in the non-traditional machining processes.	**PO1,PO12**

Text Books:

1. Advanced machining processes, VK Jain, Allied publishers.
2. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.

Reference Books:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984 2. Manufacturing Technology, Kalpakzian,Pearson
3. Modern Machining Process , Pandey P.C. and Shah H.S., TMH.

. **CO-PO Mapping**

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2										
CO2	3	2										
CO3	3	2										
CO4	3	2										
CO5	3											2
Average	**3**	**2**										**2**

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B.Tech V111 Semester (ME) **L T P C**

(18PE0318) TRIBOLOGY **3 0 0 3**

(Professional core Elective-VI)

Course Objectives:

1. To understand the principles of friction between different surfaces and materials.
2. To explain the phenomenon of wear between surfaces in contact and its implications.
3. To understand the principles, methods, purpose and selection of lubricants.
4. To know the lubrication theory and the flow of film lubricants with different applications.
5. To brief the surface treatment methods to improve the wear resistance and friction properties.

UNIT - I

SURFACES AND FRICTION: Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction - Adhesion Ploughint- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction - Stick slip motion - Measurement of Friction.

UNIT - II

WEAR: Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear - Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT - III

LUBRICANTS AND LUBRICATION TYPES: Types, properties, Requirements of Lubricants - Testing methods - Hydrodynamic Lubrication - Elasto hydrodynamic lubrication- Boundary Lubrication, Mist lubrication, Requirements of lubrication, Solid Lubrication, Hydrostatic Lubrication.

UNIT - IV

FILM LUBRICATION THEORY: Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings - Virtual Co-efficient of friction - The Somerfield diagram.

UNIT - V

SURFACE ENGINEERING AND MATERIALS FOR BEARINGS: Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes - Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the importance of friction between different surfaces and should know to calculate the friction	**PO1,PO2,PO3**
CO2	Evaluate the phenomenon of wear between surfaces in contact and its implications	**PO1,PO2,PO3**
CO3	Understand the principles, methods, purpose and selection of lubricants for the reduction of friction.	**PO1,PO2,PO3**
CO4	Summarize the lubrication theory and the flow of film lubricants with different applications	**PO1,PO2,PO3**
CO5	Brief the surface treatment methods to improve the wear resistance and friction properties.	**PO1,PO2,PO3**

Text Books:

1. I.M. Hutchings, Tribology, " Friction and Wear of Engineering Material ", Edward Arnold, London, 1992.

Reference Books:

1. T.A. Stolarski, " Tribology in Machine Design ", Industrial Press Inc., 1990.
2. Kenneth C Ludema, Friction, Wear, Lubrication: A textbook in Tribology, CRC Press,1996.
3. A.Cameron, " Basic Lubrication theory ", Longman, U.K.., 1981.
4. M.J.Neale (Editor), " Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K., 1975.

5. B.C. Majumdar "Introduction to Tribology bearings", S. Chand

. CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2									
CO2	3	2	2									
CO3	3	2	2									
CO4	3	2	2									
CO5	3	2	2									
Average	**3**	**2**	**2**									

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B.Tech V111 Semester (ME) **L T P C**

(18OE0310) PRODUCTION & OPERATION MANAGEMENT **3 0 0 3**

(Open Elective-V)

Course Objectives:

1. To understand the scope of operations management and it's functional areas
2. To study the requirement and selection of good forecasting methods and techniques
3. To understand the concept of aggregate planning and material requirement planning
4. To study the systematic approach to capacity planning and capacity management techniques
5. To understand the production activity control and lean manufacturing in an operational management

UNIT - I

Functions of Production Planning & Controls operations & productivity, productivity measurement, Design of goods and services: selection, generating new products, product development, issues in product design. Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects.

UNIT - II

Forecasting – Importance of forecasting – Types of forecasting, their uses – General Principles of forecasting – Forecasting techniques – qualitative methods and quantitive methods – accuracy of forecasting methods. Scheduling Policies – Techniques, flow shop and job shop Scheduling techniques.

UNIT - III

Factors affecting facilities location, mathematical models for facilities, location, Types of facilities- layout: product layout, process layout, group technology layout, Assembly line balancing, computerized layout: ALDEP, CRAFT, CORELAP.

UNIT - IV

Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System-Elements of total quality management, Six Sigma Quality Control. MRP, –lot sizing techniques in MRP, introduction to ERP, LOB (Line of Balance).

UNIT - V

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – various models Simple Problems.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	Describe the scope of operations management and it's functional areas	**PO1, PO11**
CO2	Understand the requirement and selection of good forecasting methods and techniques.	**PO1,PO2, PO11**
CO3	Illustrate the concept of aggregate planning and material requirement planning	**PO1,PO2, PO11**
CO4	Summarize the systematic approach to capacity planning and	**PO1, PO2, PO11**

	capacity management techniques	
CO5	Understand the production activity control and lean manufacturing in an operational management	**PO1, PO11**

Text Books:

1. Production and Operations Management, Ajay K Garg, McGrawHill, 2015
2. Operation Management by B. Mahadevan,PearsonEdu.
3. Operation and O.M by Adam & Ebert- PHI Pub.,

Reference Books:

1. Operations Management – S.N. Chary.
2. Modern Production , Operations Management , Baffa&Rakesh Sarin.

. **CO-PO Mapping**

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2										2	
CO2	2	2									2	
CO3	2	2									2	
CO4	2	2									2	
CO5	2										2	
Average	**2**	**2**									**2**	

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B.Tech V111 Semester (ME) **L T P C**

(18OE0311) SOCIAL VALUES & ETHICS **3 0 0 3**

(Open Elective-V)

Course Objectives:

To enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

UNIT - I

Introduction and Basic Concepts of Society: Family and Society: Concept of family, community, PRIs and other community based organizations and society, growing up in the family – dynamics and impact, Human values, Gender Justice.

Channels of Youth Moments for National Building: NSS & NCC: History, philosophy, aims & objectives; Emblems, flags, mottos, songs, badge etc.;Organizational structure, roles and responsibilities of various NSS functionaries. **Nehru Yuva Kendra (NYK):** Activities – Socio Cultural and Sports.

UNIT – II

Activities of NSS, NCC, NYK:

Citizenship: Basic Features Constitution of India, Fundamental Rights and Fundamental Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.

Youth and Crime: Sociological and psychological Factors influencing youth crime, Peer Mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice

Social Harmony and National Integration: Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

UNIT – III

Environment Issues: Environment conservation, enrichment and Sustainability, Climate change, Waste management, Natural resource management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).

Health, Hygiene & Sanitation: Definition, needs and scope of health education, Food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan.

Disaster Management: Introduction to Disaster Management, classification of disasters, Role of youth in Disaster Management. Home Nursing, First Aid.

Civil/ Self Defense: Civil defense services, aims and objectives of civil defense, Need for self defense training – Teakwondo, Judo, karate etc.,

UNIT – IV

Gender Sensitization: Understanding Gender – Gender inequality – Role of Family, Society and State; Challenges – Declining Sex Ratio – Sexual Harassment – Domestic Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiates of NGOs – Awareness, Movements;

UNIT - V

Physical Education : Games & Sports: Health and Recreation – Biolagical basis of Physical activity – benefiets of exercise – Physical, Psychological, Social; Physiology of Musucular Activity, Respiration, Blood Circulation**.**

Yoga: Basics of Yoga – Yoga Protocol, Postures, Asanas, Pranayama: Introduction of Kriyas, Bandhas and Mudras.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	To understand the importance of Values and Ethics in their personal lives and professional careers.	**PO1, PO11**
CO2	To learn the rights and responsibilities as an employee, team member and a global citizen.	**PO1,PO2, PO11**
CO3	Understand the importance of environmental issues.	**PO1,PO2, PO11**
CO4	Estimate the sex ratio & equality	**PO1, PO2, PO11**
CO5	To understand the importance of Education & yoga	**PO1, PO11**

TEXT BOOKS:

1. NSS MANUAL
2. SOCIETY AND ENVIRONMENT: A.S.Chauha, Jain Brothers Publications, 6th Edition, 2006
3. INDIAN SOCIAL PROBLEM: G.R.Madan, Asian Publisher House
4. INDIAN SOCIAL PROBLEM: Ram Ahuja, Rawat Publications
5. HUMAN SOCIETY: Kingsley Davis, Macmillan
6. SOCIETY: Mac Iver D Page, Macmillan
7. SOCIOLOGY – THEMES AND PERSPECTIVES: Michael Honalambos, Oxford University Press
8. CONSTITUTION OF INDIA: D.D.Basu, Lexis Nexis Butterworth Publishers
9. National Youth Policy 2014 (available on www.yas.nic.in)
10. TOWARS A WORLD OF EQUALS: A.Suneetha, Uma Bhrugudanda, Duggirala Vasantha, Rama Melkote, Vasudha Nagraj, Asma Rasheed, Gogu Shyamala, Deepa Streenivas and Susie Tharu

11. LIGHT ON YOGA : B.K.S.Iyengar, Penguin Random House Publishers

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2										2	
CO2	2	2									2	
CO3	2	2									2	
CO4	2	2									2	
CO5	2										2	
Average	**2**	**2**									**2**	

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B.Tech V111 Semester (ME) **L T P C**

(18OE0312) CONCURRENT ENGINEERING **3 0 0 3**

(Open Elective-V)

UNIT - I

INTRODUCTION: Sequential engineering process, Concurrent engineering definition and requirement, meaning of concurrent objectives of CE, benefits of CE, Life cycle design of products, life cycle costs.

SUPPORT FOR CE: Classes of support for CE activity, CE organizational, structure CE, team composition and duties, Computer based Support, CE Implementation Process.

UNIT - II

DESIGN PRODUCT FOR CUSTOMER: Industrial Design, Quality Function Deployment, house of quality, Translation process of quality function deployment (QFD). Modeling of Concurrent engineering design- Compatibility approach, Compatibility index, implementation of the Compatibility model, integrating the compatibility Concerns

UNIT - III

DESIGN FOR MANUFACTURE (DFM): Introduction, role of DFM in CE, DFM methods, e.g. value engineering, DFM guidelines, design for assembly, creative design methods, product family themes, design axioms, Taguchi design methods, Computer based approach to DFM. Evaluation of manufacturability and assembliability.

UNIT - IV

QUALITY BY DESIGN: Quality engineering & methodology for robust product design, parameter and Tolerance design, Quality loss function and signal to noise ratio for designing the quality, experimental approach.

UNIT - V

DESIGN FOR X-ABILITY: Design for reliability, life cycle serviceability design, design for maintainability, design for economics, decomposition in concurrent design, concurrent design case studies.

Course Outcomes:

On successful completion of the course, Students will be able to		**POs related to COs**
CO1	To understand the concept and need for sequential engineering or Concurrent engineering and it's benefit for the modern industry.	**PO1, PO11**
CO2	To understand the co-operation/ coordination required between the different departments like marketing, design and the latest softwares available sofar.	**PO1,PO2, PO11**
CO3	To know the different procedures to be followed during the design, modifications, and optimization techniques for the Design for Manufacture (DFM).	**PO1,PO2, PO11**
CO4	To understand the importance of quality of the product and know the methods of evaluating the quality.	**PO1, PO2, PO11**

CO5	Able to assess the reliability & economics of the Design for Manufacture (DFM) being done/ learned.	**PO1, PO11**

Text Books:

1. Concurrent Engineering- Kusiak - John Wiley & Sons

2. Concurrent Engineering- Menon - Chapman & Hall

Reference Books:

1.Integrated Product Development/Anderson MM and Hein, L.Berlin, Springer Verlog,1987.

2.Design for Concurrent Engineering/ Cleetus, J. Concurrent Engg. Research Centre,Morgantown,WV, 1992.

Student can be directed to industries who uses the Concurrent Engineering concepts.

CO-PO Mapping

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2										2	
CO2	2	2									2	
CO3	2	2									2	
CO4	2	2									2	
CO5	2										2	
Average	**2**	**2**									**2**	