COURSE STRUCTURE AND SYLLABUS

For

B.Tech

MECHANICAL ENGINEERING

(*Applicable for batches admitted from 2016-17*)

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Permanently Affiliated to JNTUK, Kakinada, Accredited by NAAC with "A" Grade
Recognized by UGC 2(f) and 12(b) under UGC act, 1956
1-378, ADB Road, Surampalem – 533 437
Near Peddapuram, E.G.Dist, Andhra Pradesh

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

ACADEMIC REGULATIONS FOR B.TECH (REGULAR)

Applicable for the students of B.Tech (Regular) Admitted from the academic year 2016-2017.

1. AWARD OF B.TECH DEGREE

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

1.1 A Student shall be declared eligible for the award of the B.Tech Degree, if he pursues a course of study for not less than four and for not more than eight academic years.

1.2 The candidate shall register for 180 credits and secure all the 180 credits.

2. COURSES OF STUDY

The following courses of study are offered at present as specializations for the B.Tech course with English as medium of instruction.

S. No.	***Branch / Course***
01.	Civil Engineering (CE)
02.	Electrical and Electronics Engineering (EEE)
03.	Mechanical Engineering (ME)
04.	Electronics and Communications Engineering (ECE)
05.	Computer Science and Engineering (CSE)
06.	Information Technology (IT)

3. MINIMUM INSTRUCTIONS DAYS.

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

4. PROGRAMME/ COURSE CREDITS

4.1. Each discipline / course of the four year B.Tech programme is designed to have a total of 180 credits**.** Depending upon the nature of each subject and the number of periods of instruction whether it is theory, laboratory, drawing etc., weightages are given in terms of number of credits. See course structure for details.

5. ATTENDANCE REQUIREMENTS :

5.1. A student is eligible to appear for the End semester examinations only if he puts in a minimum of 75% of attendance in aggregate of all the subjects.

5.2. Condonation of shortage of attendance in the aggregate upto 10% (65% and above and below 75%) in each semester may be granted by a committee appointed for this purpose, after getting satisfied that the absence is due to genuine reasons.
5.3. Shortage of attendance below 65% in aggregate shall not be condoned.
5.4. A student who has shortage of attendance in a semester may seek readmission in to the course when offered next.
5.5. A fee stipulated by the college shall be paid along with the application for the condonation of shortage of attendance.
5.6. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations and the registration shall stand cancelled.

6. DISTRIBUTION AND WEIGHTAGE OF MARKS

The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks. 40 marks for internal evaluation and 60 marks for the end examination have been earmarked. The Project Work shall be evaluated for 200 marks. The mini project/Term Paper/Seminar has a weightage of 50 marks and evaluated internally.

Depending upon the nature of the subject, the distribution and weightages for internal and external assessment are as detailed below:

6.1. Theory Subjects

i. Internal assessment : 40 marks

a) For the Mid examinations there shall be two tests, one conducted in the middle and the other at the end of each semester. The duration of each test is two hours. The question paper contains **Part-A** and **Part-B**. Part-A consists of three questions. Out of three questions two questions carry seven marks and one question carry six marks. Part-B consists of twenty objective type questions each carry half mark. Answering all questions is compulsory.
b) Students shall submit assignments at the end of each unit in the syllabus and the marks allotted for the assignments is 10.
c) The formula for finding the total marks of internal assessment (40 marks) = 0.80 x higher marks scored between the two internal tests + 0.20 x marks scored in the other test + marks for the assignments.

ii. External assessment :

a) The end semester examination is of 3 hours duration and contains **Part A** and **Part B**. It covers all the topics in all the 6 units and the weightage is 60 marks.
b) Part A consists of 6 short questions each carrying 2 marks (6 x 2 = 12 marks). These 6 questions are compulsory and cover all the 6 units in the syllabus.

c) Part B consists of 6 essay type / numerical questions, One question is set from each unit in the syllabus. Some questions may have sub sections. The student has to answer 4 out of 6 questions, each question with a weightage of 12 marks (4 x 12) = 48 marks.

6.2. Laboratory Courses

i. Internal assessment : 40 marks

There shall be continuous evaluation during the semester for 40 marks as shown below:

Day-to-Day work and laboratory record	-	25 marks
One internal test at the end of the semester	-	15 marks
Total	-	**40 Marks**

ii. External Assessment :

At the end of the semester an examination for 3 hours duration shall be conducted for 60 marks by the concerned teacher and an external examiner.

6.3. Subjects such as Engineering Graphics, Engineering Drawing, Machine Drawing, Design and Drawing of R.C. Structures, Steel structures, Irrigation structures, Estimation cost and valuation, Building Planning and Drawing etc.

i. Internal assessment : 40 marks

a) There shall be continuous evaluation with a weightage of 40 marks as shown below :

Day-to-Day work	-	20 marks

b) Internal tests :

There shall be two internal tests One in the middle of the semester and the other at the end. Marks for Internal Tests = 0.8 x higher marks scored between the two tests + 0.2 x marks scored in the other test. - 20 marks

Total	-	**40 Marks**

ii. External assessment :

Same as for theory subjects given in 6.1.ii.

6.4. Mini Project /Term paper

There shall be a Mini Project/Term paper in the III year I / II semester. It has a weightage of 50 marks and evaluated internally at the end of the semester.

6.5. Project

Out of a total of 200 marks for the Project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva-voce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department and Supervisor of the Project. The Evaluation of project work shall be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee.

6.6. Seminar

For the Seminar, Each student has to be evaluated based on the presentation of any latest topic with a report of 10-15 pages and a power point presentation of minimum 10 slides. The student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

7. MINIMUM ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned under rule 5.

7.1. A Student is deemed to have satisfied the minimum academic requirements if he has **earned the credits allotted to each theory / practical design / drawing subject by securing not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the internal marks and end semester examination marks.**

7.2. A Student is deemed to have satisfied the minimum academic requirements if he has **earned the credits allotted to each laboratory / project by securing not less than 40% of marks in the end semester exam, and minimum 50% of marks in the sum total of the internal marks and end semester examination marks.**

7.3. A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to mini project/term paper and seminar by securing not less than 50% of Marks.

7.4. A student shall register and put in minimum attendance in all 180 credits and earn all 180 credits.

8. COURSE PATTERN

8.1. The entire course of study is for four academic years, all the years are on semester pattern.

8.2. A student eligible to appear for the end semester examination in a subject, but absent or failed in the end semester examination, may write the examination in that subject when conducted next.

8.3. When a student is detained due lack of credits / shortage of attendance, he may be re-admitted into the same semester / year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

9. PROMOTION TO NEXT HIGHER CLASS

9.1. A Student shall be promoted from 1st year to II year if he fulfills the minimum attendance requirement under rule 5.

9.2. A Student shall be promoted from II year to III year, if he fulfills the academic requirement of 50% of the credits upto II year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

9.3. A student shall be promoted from III year to IV year if he fulfills the academic requirements of 50% of the credits upto III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

10. CUMULATIVE GRADE POINT AVERAGE (CGPA)

Theory/Design/ Drawing (%)	Laboratory/Mini Project/Term Paper/ Project/ Seminar (%)	Letter Grade	Level	Grade Point
≥ 90	≥ 90	O	Outstanding	10
≥ 80 to < 90	≥ 80 to < 90	S	Excellent	9
≥ 70 to < 80	≥ 70 to < 80	A	Very Good	8
≥ 60 to < 70	≥ 60 to < 70	B	Good	7
≥ 50 to < 60	≥ 50 to < 60	C	Fair	6
≥ 40 to < 50	--	D	Satisfactory	5
<40	<50	F	Fail	0
			Absent	0

Computation of Semester Grade Point Average (SGPA)

The following procedure is to be adapted to compute the Semester Grade Point Average. (SGPA) and Cumulative Grade Point Average (CGPA).

The **SGPA** is the ratio of sum of 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.

$$\textbf{SGPA (Si)} = \sum(Ci \times Gi) / \sum Ci$$

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

Computation of CGPA

- The **CGPA** is also calculated in the same manner taking into account all the courses undergone by a student over all the semester of a programme i.e.,

$$\textbf{CGPA} = \sum(Ci \times Si) / \sum Ci$$

- Where Si is the SGPA of the i^{th} semester and Ci 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.
- Equivalent Percentage = (CGPA – 0.75) x 10

11. AWARD OF CLASS

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

Class Awarded	CGPA to be secured	
First Class with Distinction	≥ 7.75 (Without any Supplementary Appearance)	**From the CGPA secured from 180 credits**
First Class	≥ 6.75 to < 7.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 4.75 to < 5.75	

12. WITHHOLDING OF RESULTS :

If the students has not paid the dues, if any, to the college or if any case of indiscipline or malpractice is pending against him, the examination results of the student will be withheld.

13. TRANSITORY REGULATIONS:

13.1. For Re-admitted Candidates:

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

ii) A student who is following JNTUK curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of first year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the Programme prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree.

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

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

v) In case the students who do not have option of acquiring required credits with the existing courses offered as per the curriculum under autonomy, credit balance can be achieved by clearing the additional courses offered. The additional courses that are offered can be of theory or laboratory courses.

13.2. Transfer candidates (from non-autonomous college affiliated to JNTUK):

i) A student who is following JNTUK curriculum, transferred from other college to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the Programme prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree.

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

iii) The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will

be the sum of the credits upto previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

iv) In case the students who do not have option of acquiring required credits with the existing courses offered as per the curriculum under autonomy, credit balance can be achieved by clearing the additional courses offered. The additional courses that are offered can be of theory or laboratory courses.

13.3. Transfer candidates (from an autonomous college affiliated to JNTUK):

i) A student who has secured the required credits upto previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this college.

ii) A student who is transferred from the other autonomous colleges to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the Programme prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree.

iii) However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

iv) In case the students who do not have option of acquiring required credits with the existing courses offered as per the curriculum under autonomy, credit balance can be achieved by clearing the additional courses offered. The additional courses that are offered can be of theory or laboratory courses.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

ACADEMIC REGULATIONS FOR B.TECH LATERAL ENTRY SCHEME (LES)

Applicable for the students admitted into II year B.Tech I semester from the Academic year 2017-18.

1. AWARD OF B.TECH DEGREE

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

1.1. A Student shall be declared eligible for the award of the B.Tech Degree, if he pursues a course of study for not less than three academic years and not more than six academic years.

1.2 The candidate shall register for 132 credits and secure all the 132 credits.

2. The attendance regulations of B.Tech (Regular) shall be applicable to B.Tech (LES) students as well.

3 PROMOTION RULES

3.1. A Student shall be promoted from II year to III year, if he fulfills the minimum attendance requirement under rule 5 of B.Tech (Regular).

3.2. A student shall be promoted from III year to IV year if he fulfills the academic requirements of 50% of the credits upto III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4. AWARD OF CLASS

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

Class Awarded	CGPA to be secured	
First Class with Distinction	≥ 7.75 (Without any Supplementary Appearance)	**From the CGPA secured from 132 credits**
First Class	≥ 6.75 to < 7.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 4.75 to < 5.75	

5. All the other regulations as applicable to **B.Tech 4-year degree course (Regular) will hold good for B.Tech (Lateral Entry Scheme) also.**

GENERAL :

i) Whenever the words “he”, “him”, “his” secure in the regulations, they include “she”, “her”, “hers”.

ii) The academic rules and regulations should be read as a whole for the purpose of interpretation.

iii) In case of any doubt or ambiguity in the interpretation of rules, the decision of the Principal of the college is final.

iv) The college may change or amend the academic rules and regulations or syllabi at any time and the changed rules come into effect from the date of issue of such orders.

MALPRACTIES RULES

The rules laid down in JNTUK R16 regulations will be followed into to.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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I Year – I Semester

S.No.	Subject Code	Subjects	L	T	P	C
1	16BH1T01	English – I	4	--	--	3
2	16BH1T03	Mathematics - I	4	--	--	3
3	16BH1T11	Engineering Chemistry	4	--	--	3
4	16ME1T01	Engineering Mechanics	4	--	--	3
5	16CS1T01	Computer Programming Using C	4	--	--	3
6	16BH1T13	Environmental Studies	4	--	--	3
7	16BH1L05	Engineering/Applied Chemistry Laboratory	--	--	3	2
8	16BH1L01	English - Communication Skills Lab - I	--	--	3	2
9	16CS1L10	C-Programming Lab	--	--	3	2
Total Credits						**24**

I Year – II Semester

S.No	Subject Code	Subjects	L	T	P	C
1	16BH2T02	English – II	4	--	--	3
2	16BH2T04	Mathematics – II (Mathematical Methods)	4	--	--	3
3	16BH2T06	Mathematics – III	4	--	--	3
4	16BH2T09	Engineering Physics	4	--	--	3
5	16EE2T03	Basic Electrical and Electronics Engineering	4	--	--	3
6	16ME2T02	Engineering Drawing	2	--	3	3
7	16BH2L02	English - Communication Skills Lab - II	--	--	3	2
8	16BH2L03	Engineering /Applied Physics Lab	--	--	3	2
9	16BH2L04	Engineering /Applied Physics – Virtual Labs - Assignments	--	--	2	--
10	16ME2L01	Engineering Workshop & IT Workshop	--	--	3	2
Total Credits						**24**

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II Year – I Semester

S.No.	Subject Code	Subjects	L	T	P	C
1	16ME3T04	Metallurgy & Materials Science	4	--	--	3
2	16ME3T05	Mechanics of Solids	4	--	--	3
3	16ME3T06	Thermodynamics	4	--	--	3
4	16BH3T14	Managerial Economics & Financial Analysis	4	--	--	3
5	16ME3T07	Fluid Mechanics & Hydraulic Machines	4	--	--	3
6	16ME3T08	Computer Aided Engineering Drawing Practice	3	3	--	3
7	16EE3L03	Electrical & Electronics Engineering Lab	--	--	3	2
8	16ME3L02	Mechanics of Solids & Metallurgy Lab	--	--	3	2
Total Credits						**22**

II Year – II Semester

S.No.	Subject Code	Subjects	L	T	P	C
1	16ME4T10	Kinematics of Machinery	4	--	--	3
2	16ME4T11	Thermal Engineering -I	4	--	--	3
3	16ME4T12	Production Technology	4	--	--	3
4	16ME4T13	Design of Machine Members -I	4	--	--	3
5	16ME4T14	Machine Drawing	3	3	--	3
6	16ME4T15	Industrial Engineering and Management	4	--	--	3
7	16ME4L04	Fluid Mechanics & Hydraulic Machinery Lab	--	--	3	2
8	16ME4L05	Production Technology Lab	--	--	3	2
Total Credits						**22**

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III Year – I Semester

S.No.	Subject Code	Subjects	L	T	P	C
1	16ME5T16	Dynamics of Machinery	4	--	--	3
2	16ME5T17	Metal Cutting & Machine Tools	4	--	--	3
3	16ME5T18	Design of Machine Members–II	4	--	--	3
4	16ME5T19	Operations Research	4	--	--	3
5	16ME5T20	Thermal Engineering -II	4	--	--	3
6	16ME5L06	Theory of Machines Lab	--	--	3	2
7	16ME5L07	Machine Tools Lab	--	--	3	2
8	16ME5L08	Thermal Engineering Lab	--	--	3	2
9	16BH5T16	IPR & Patents	--	2	--	--
10	16ME5M01	MOOCS	--	3	--	--
Total Credits						**21**

III Year – II Semester

S.No.	Subject Code	Subjects	L	T	P	C
1	16ME6T21	Metrology	4	--	--	3
2	16ME6T22	Instrumentation & Control Systems	4	--	--	3
3	16ME6T23	Refrigeration & Air-conditioning	4	--	--	3
4	16ME6T24	Heat Transfer	4	--	--	3
5	**OPEN ELECTIVE**					
	16BH6E01	1. Entrepreneurship	4	--	--	3
	16CS6E04	2. Data Base Management System				
	16CE6E01	3. Waste Water Management				
	16CS6E05	4. Computer Graphics				
	16ME6E01	5. Robotics				
	16CE6E04	6. Green Engineering Systems				
6	16ME6L09	Heat Transfer Lab	--	--	3	2
7	16ME6L10	Metrology & Instrumentation Lab	--	--	3	2
8	16ME6P01	Mini project / Term paper	--	--	3	2
9	16BH6T17	Professional Ethics & Human Values	--	3	--	--
Total Credits						**21**

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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IV Year – I Semester

S.No.	Subject Code	Subjects	L	T	P	C
1	16ME7T25	Mechatronics	4	--	--	3
2	16ME7T26	CAD/CAM	4	--	--	3
3	16ME7T27	Finite Element Methods	4	--	--	3
4	16ME7T28	Power Plant Engineering	4	--	--	3
5	**Elective I**					
	16ME7D01	1. Computational Fluid Dynamics	4	--	--	3
	16ME7D02	2. Condition Monitoring				
	16ME7D03	3. Additive Manufacturing				
6	**Elective II**					
	16ME7D04	1. Advanced Materials	4	--	--	3
	16ME7D05	2. Design for Manufacture				
	16ME7D06	3. Gas Dynamics & Jet Propulsion				
7	16ME7L11	CAD/CFD Lab	--	--	3	2
8	16ME7L12	CAM/Mechatronics Lab	--	--	3	2
Total Credits						**22**

IV Year – II Semester

S.No.	Subject Code	Subjects	L	T	P	C
1	16ME8T29	Production Planning and Control	4	--	--	3
2	16ME8T30	Unconventional Machining Processes	4	--	--	3
3	16ME8T31	Automobile Engineering	4	--	--	3
4	**Elective III**					
	16ME8D08	1. Thermal Equipment Design	4	--	--	3
	16ME8D09	2. Non Destructive Evaluation				
	16ME8D10	3. Quality and Reliability Engineering				
5	16ME8S01	Seminar	--	3	--	2
6	16ME8P02	Project Work	--	--	--	10
Total Credits						**24**

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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L	T	P	C
4	0	0	3

I Year I Semester

Subject Code: 16BH1T01

ENGLISH – I

Introduction:
In view of the growing importance of English as a tool for global communication and the consequent emphasis on training the students have to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of the students of Engineering. As far as the detailed Textbooks are concerned, the focus should be on the skills of listening, speaking, reading and writing. The non-detailed Textbooks are meant for extensive reading for pleasure and profit. Thus, the stress in the syllabus is primarily on the development of communicative skills and fostering of ideas.

Objectives:
To improve the language proficiency of the students in English with emphasis on LSRW skills.

1. To enable the students to study and comprehend the prescribed lessons and subjects more effectively relating to their theoretical and practical components.
2. To develop the communication skills of the students in both formal and informal situations.

LISTENING SKILLS:
Objectives:

1. To enable the students to appreciate the role of listening skill and improve their pronunciation.
2. To enable the students to comprehend the speech of people belonging to different backgrounds and regions.
3. To enable the students to listen for general content, to fill up information and for specific information.

SPEAKING SKILLS:
Objectives:

1. To make the students aware of the importance of speaking for their personal and professional communication.
2. To enable the students to express themselves fluently and accurately in social and professional success.
3. To help the students describe objects, situations and people.
4. To make the students participate in group activities like role-plays, discussions and debates.
5. To make the students participate in Just a Minute talks.

READING SKILLS:

Objectives:

1. To enable the students to comprehend a text through silent reading.
2. To enable the students to guess the meanings of words, messages and inferences of texts in given contexts.
3. To enable the students to skim and scan a text.
4. To enable the students to identify the topic sentence.
5. To enable the students to identify discourse features.
6. To enable the students to make intensive and extensive reading.

WRITING SKILLS:

Objectives:

1. To make the students understand that writing is an exact formal skills.
2. To enable the students to write sentences and paragraphs.
3. To make the students identify and use appropriate vocabulary.
4. To enable the students to narrate and describe.
5. To enable the students capable of note-making.
6. To enable the students to write coherently and cohesively.
7. To make the students to write formal and informal letters.
8. To enable the students to describe graphs using expressions of comparison.
9. To enable the students to write technical reports.

Methodology:

1. The classes are to be learner-centred where the learners are to read the texts to get a comprehensive idea of those texts on their own with the help of the peer group and the teacher.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The tasks/exercises at the end of each unit should be completed by the learners only and the teacher intervention is permitted as per the complexity of the task/exercise.
4. The teacher is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The teacher is permitted to use lecture method when a completely new concept is introduced in the class.

DETAILED TEXTBOOKS:

- *ENGLISH FOR ENGINEERS AND TECHNOLOGISTS, Published by Orient Blackswan Pvt Ltd*

- *THE COP AND THE ANTHEM BY O. HENRY PUBLISHED BY PERFECTION LEARNING*

NON-DETAILED TEXTBOOK:

- *-PANORAMA: A COURSE ON READING, Published by Oxford University Press India*

The course content along with the study material is divided into six units.

UNIT I:

1. 'Human Resources' from English for Engineers and Technologists.

Objective:
To develop human resources to serve the society in different ways.
Outcome:
The lesson motivates the readers to develop their knowledge different fields and serve the society accordingly.

2. 'An Ideal Family' from Panorama: A Course on Reading

Objective:
To develop extensive reading skill and comprehension for pleasure and profit.
Outcome:
Acquisition of writing skills

UNIT 2:

1. ' Transport: Problems and Solutions' from English for Engineers and Technologists.

Objective:
To highlight road safety measures whatever be the mode of transport.
Outcome:
The lesson motivates the public to adopt road safety measures.

2. 'War' from 'Panorama : A Course on Reading'

Objective:
To develop extensive reading skill and comprehension for pleasure and profit.
Outcome:
Acquisition of writing skills

UNIT 3:

Unit 3 has two sections: Unit 3(A) and 3(B)

3(A):

1. 'Evaluating Technology' from English for Engineers and Technologists.

Objective:
To highlight the advantages and disadvantages of technology.
Outcome:
The lesson creates an awareness in the readers that mass production is ultimately survival.

2. 'The Verger' from 'Panorama : A Course on Reading'

Objective:

To develop extensive reading skill and comprehension for pleasure and profit.
Outcome:
Acquisition of writing skills

Unit 3(B)

- *1. THE COP AND THE ANTHEM BY O.HENRY*

Objective:
To enable students to develop interest in reading and appreciating short stories of different genres.
Outcome:
This lesson motivates students to respond and express the ideas and feelings in the story through oral, written and performative means.

UNIT 4:

1. 'Alternative Sources of Energy' from English for Engineers and Technologists.
Objective:
To bring into focus different sources of energy as alternatives to the depleting sources.
Outcome:
The lesson helps to choose a source of energy suitable for rural India.

2. ' The Scarecrow' from Panorama : A Course on Reading
Objective:
To develop extensive reading skill and comprehension for pleasure and profit.
Outcome:
Acquisition of writing skills.

UNIT 5:

1. 'Our Living Environment' from English for Engineers and Technologists.
Objective:
To highlight the fact that animals must be preserved because animal life is precious.
Outcome:
The lesson creates an awareness in the reader as to the usefulness of animals for the human society.

2. 'A Village Host to Nation' from Panorama : A Course on Reading
Objective:
To develop extensive reading skill and comprehension for pleasure and profit.
Outcome:
Acquisition of writing skills

UNIT 6:

1. ' Safety and Training' from English for Engineers and Technologists.
Objective:
To highlight the possibility of accidents in laboratories, industries and other places and to follow safety measures.
Outcome:

The lesson helps in identifying safety measures against different varieties of accidents at home and in the workplace.

2. 'Martin Luther King and Africa' from Panorama : A Course on Reading

Objective:

To develop extensive reading skill and comprehension for pleasure and profit.

Outcome:

Acquisition of writing skills

NOTE:

All the exercises given in the prescribed lessons in both detailed and non-detailed textbooks relating to the theme and language skills must be covered.

OVERALL COURSE OUTCOME:

CO#	Statement	Cognitive Level
CO1	Enables the learners to acquire knowledge in different fields besides the acquisition of Reading and Writing skills to apply in their real life situations.	
CO2	Explains the learners about transport and road safety methods to make use of them in that phenomenon and extends their reading and writing skills.	
CO3	Creates awareness on importance of mass production in the survival of mankind and strengthens them in reading and writing aspects.	
CO4	Helps the learners to identify the required sources of energy for rural India and practice their reading and writing skills.	
CO5	Creates awareness in the readers on ecological system and supports the learners in improving reading and writing skills.	
CO6	Prepares the learners to have an industrial etiquette and training and promotes their reading and writing skills	

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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L	T	P	C
3	1	0	3

I Year I Semester

Subject Code: 16BH1T03

MATHEMATICS – I

Course Objectives:

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

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

CO#	Statement	Cognitive Level
CO1	Solve the linear system of equations by using different methods.	
CO2	Find the Eigen values and Eigen vectors and also finding inverse and power of a matrix by using Cayley - Hamilton theorem.	
CO3	Find rank, index, signature and nature of a Quadratic form.	
CO4	Solve first order differential equations and able to apply physical problems.	
CO5	Solve higher order linear differential equations with constant coefficients.	
CO6	Find partial derivate of different orders, finding maxima and minima of a function of two variable, three variables and functional dependence.	

UNIT I: Linear systems of equations

Rank-Echelon form-Normal form – Solution of linear systems – Gauss elimination - Gauss Jordon- Gauss Jacobi and Gauss Seidel methods.

Applications: Finding the current inelectrical circuits.

UNIT II: Eigen values - Eigen vectors

Eigen values - Eigen vectors– Properties – Cayley-Hamilton theorem - Inverse and powersof a matrix by using Cayley-Hamilton theorem- Diagonalization.

Applications: Free vibration of a two-mass system.

UNIT III–Quadratic forms

Quadratic formsReduction of quadratic form to canonical form – Rank - Positive, negative and semi definite- Index – Signature.

UNIT IV: Differential equations of first order and first degree
Linear-Bernoulli-Exact-Reducible to exact.
Applications: Newton's Law of cooling-Law of natural growth and decay-Orthogonaltrajectories-Electrical circuits- Chemical reactions.

UNIT V: Linear differential equations of higher order
Non-homogeneous equations of higher order with constant coefficients with RHS term of the typee^{ax}, $\sin ax, \cos ax$, polynomials in x, $e^{ax}V(x)$, $xV(x)-$ Method of Variation ofparameters.
Applications: LCR circuit, Simple Harmonic motion.

UNIT VI: Partial differentiation
Introduction- Homogeneous function-Euler's theorem-Total derivative-Chain ruleGeneralized Mean value theorem for single variable (without proof)-Taylor's and McLaurent's series expansion of functions of two variables - Jacobian– Functional dependence.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

Text Books:

1. **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **N.P.Bali,** Engineering Mathematics, Lakshmi Publications.
3. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India

Reference Books:

1. **Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2. **Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3. **Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4. **Srimanta Pal, SubodhC.Bhunia**, Engineering Mathematics, Oxford UniversityPress.
5. **Dass H.K., RajnishVerma. Er**, Higher Engineering Mathematics, S. Chand Co.Pvt. Ltd, Delhi.

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L	T	P	C
4	0	0	3

I year - I semester

Subject Code: 16BH1T11

ENGINEERING CHEMISTRY

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

UNIT I: HIGH POLYMERS AND PLASTICS

Polymerisation:- Definition- Types of Polymers - Mechanism of polymerization- Stereo regular polymers- Methods of polymerization(emulsion and suspension)-Physical and Mechanical properties.

Plastics as engineering materials: advantages and limitations- Thermoplastics and Thermosetting plastics Compounding and fabrication (Compression, Injection, Extrusion and Blown Techniques)- Preparation, properties and applications of polyethene, PVC, Bakelite Teflon, Poly methyl Methacrylate (PMMA) *and* polycarbonates

Elastomers :- Natural rubber- Disadvantages- Mastication - compounding and vulcanization - Synthetic rubbers : Buna S, Buna N, Thiokol and polyurethanes - Applications of elastomers.

Composite materials & Fiber reinforced plastics - Biodegradable polymers - Conducting polymers.

Learning Objectives: Plastics are nowadays used in household appliances; They are also used as composites (FRP) in aerospace and automotive industries.

Outcomes: The advantages and limitations of plastic materials and their use in design would be understood.

UNIT II: FUEL TECHNOLOGY

Fuels – Definition –Classification - Characteristics of a good fuel - Calorific value - HCV and LCV - Dulong's formula - Bomb calorimeter – Numerical problems - Coal -- Proximate and Ultimate analysis and their Significance - Liquid fuels - Petroleum- Origin and Refining - Cracking - Synthetic petrol -Petrol knocking - Diesel knocking - Octane and Cetane ratings - Anti-knock agents - Power alcohol – Bio diesel, Gaseous fuels: - Natural gas, LPG and CNG, Combustion - Calculation of air for the combustion of a fuel, Flue gas analysis – Orsat's apparatus - Numerical problems on combustion

Explosives:- Rocket fuels

Learning Objectives: Fuels as a source of energy are a basic need of any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence are introduced to create awareness on the topics.

Outcomes: Fuels which are used commonly and their economics, advantages and limitations can be understood by the students and create awareness on the topics.

UNIT III: ELECTROCHEMICAL CELLS AND CORROSION

Galvanic cells - Reversible and irreversible cells - Single electrode potential - Electro chemical series and uses of this series- Standard electrodes (Hydrogen ,Calomel and Glass electrode) - Concentration Cells - Batteries: Dry Cell - Ni-Cd cells - Ni-Metal hydride cells - Li cells - Zinc - air cells.

Fuel cells: - Hydrogen Oxygen fuel cells - Methanol Oxygen fuel cells

Corrosion :- Definition - Theories of Corrosion (chemical & electrochemical) - Formation of galvanic cells by different metals, by concentration cells, by differential aeration and waterline

corrosion - Passivity of metals -Pitting corrosion – *Corrosion under insulation* -Galvanic series - Factors which influence the rate of corrosion –Protection from corrosion -Design and material selection - Cathodic protection - Protective coatings: - Surface preparation - Metallic (galvanizing and tinning) coatings - Methods of application on metals (Electroplating, Electroless plating).

Learning Objectives: The basics for the construction of galvanic cells are introduced to have understanding on the concepts. Understanding on the concept of Corrosion and Mechanism of Corrosion with Theories like Electrochemical theory. .

Outcomes: Corrosion – its theories and controlling methods can create Understanding and awareness on the topic.

UNIT IV: CHEMISTRY OF ADVANCED MATERIALS

Nano materials:- Introduction - Sol-gel method & chemical reduction method of preparation- Characterization by Braunear Emmett Teller(BET) method, Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM)_ methods - Carbon nano tubes : Types, preparation(*Laser ablation, Chemical vapour deposition methods*), properties and applications, Fullerenes.

Liquid crystals:- Introduction - Types - Applications

Super conductors:-Type -I, Type II - Characteristics and applications

Green synthesis:- Principles of Green Chemistry - Methods of synthesis (Aqueous Phase Method, Super Critical Fluid Extraction and Phase Transfer Catalysis) with examples - R_4M_4 principles

Learning Objectives: With the increase in demand, a wide variety of materials are coming up; some of them have excellent engineering properties and a few of these materials are introduced in **Unit – IV.**

Outcomes: The students will have awareness on now aware of materials like nano materials and fullerenes and their applications. Study on liquid crystals and superconductors can create Understanding for their applications in various fields. The importance of green synthesis create better Understanding for application and also can create better Understanding compared to conventional methods is also explained.

UNIT V: WATER TECHNOLOGY

Hard water:- Reasons for hardness - units of hardness - determination of hardness and alkalinity - Water for steam generation - Boiler troubles - Priming and Foaming, Scale formation, Boiler corrosion, Caustic embrittlement - Internal treatments - Softening of Hard water : Lime - Soda process, Zeolite process and numerical problems based on these processes and Ion Exchange process - Water for drinking purposes Purification - Sterilization and disinfection : Chlorination, Break point chlorination and other methods - Reverse Osmosis and Electro Dialysis.

Learning Objectives: Water is necessary in almost all the industries, more so where steam is generated and also where it is supplied for drinking purposes. Problems associated with Water quality Methods to be used to Control or remove the Hardness

Outcomes: The impurities present in raw water, problems associated with them and how to eliminate them can be understood.

UNIT VI: *CHEMISTRY OF ENGINEERING MATERIALS*

Refractories: - Definition, classification, characteristics (Thermal conductivity, Porosity, Refractoriness, *Refractoriness under load*) and failures
Lubricants: - Definition, function, *Types of lubricants*, properties (Definition and importance)
Cement: - Constituents, manufacturing, hardening and setting, decay of concrete.
Bio Materials:- Definition – Characteristics- Applications
Insulators: - Thermal and electrical insulators

Learning Objectives: Materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries are introduced with a Special emphasis on Refractories, Lubricants, Cement, Insulators, Bio materials and fuel cells.

Outcomes: The advantages and limitations of plastic materials and their use in design would be understood. Awareness on commonly used industrial materials can create better Understanding on the Usage of Materials Used for various applications.

Text Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

Reference Books:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
2. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
4. Applied Chemistry by H.D. Gesser, Springer Publishers
5. Text book of Nano-science and nanotechnology by B.S. Murthy,P. Shankar and others, University Press, IIM

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L	T	P	C
4	0	0	3

I Year - I Semester

Subject Code: 16ME1T01

ENGINEERING MECHANICS

Objectives: The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, Forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

UNIT – I

Objectives: The students are to be exposed to the concepts of force and friction, direction and its application.

Introduction to Engg. Mechanics – Basic Concepts.

Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Friction: Introduction**,** limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction, Problems on wedges.

UNIT II

Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium, analysis of plane trusses.

UNIT – III

Objectives : The students are to be exposed to concepts of centre of gravity.

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

UNIT IV

Objective: The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia:

Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – V

Objectives: The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion. **Kinetics:** Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies, Principle of virtual work.

UNIT – VI

Objectives: The students are to be exposed to concepts of work, energy and particle motion

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method., Law of conservation of momentum

TEXT BOOKS :

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

REFERENCES :

1. Engineering Mechanics statics and dynamics – R.C.Hibbeler, 11th Edn – Pearson Publ.
2. Engineering Mechanics, statics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
3. Engineering Mechanics, statics and dynamics – I.H.Shames, – Pearson Publ.
4. Mechanics For Engineers, statics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
5. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston –5th Edn Mc Graw Hill Publ.
6. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best & W.G.
McLean, 5th Edn – Schaum's outline series - Mc Graw Hill Publ.
7. Singer's Engineering Mechanics: Statics And Dynamics, K. Vijay Kumar Reddy, J. Suresh Kumar, Bs
Publications
8. Engineering Mechanics, Fedinand . L. Singer, Harper – Collins.
9. Engineering Mechanics statics and dynamics , A Nelson , Mc Graw Hill publications
10. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/engg_mechanics/ui/Course_home_3.htm
11. http://nptel.ac.in/courses/122104015/
12. https://www.youtube.com/watch?v=LG0YzGeAFxk

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L	T	P	C
4	0	0	3

I Year - I Semester

Subject Code: 16CS1T01

COMPUTER PROGRAMMING USING C

Learning objectives:

Formulating algorithmic solutions to problems and implementing algorithms in C.

- Notion of Operation of a CPU, Notion of an algorithm and computational procedure, editingand executing programs in Linux.
- Understanding branching, iteration and data representation using arrays.
- Modular programming and recursive solution formulation.
- Understanding pointers and dynamic memory allocation.
- Understanding miscellaneous aspects of C.
- Comprehension of file operations.

UNIT-I:

History and Hardware - Computer Hardware, Bits and Bytes, Components, Programming Languages - Machine Language, Assembly Language, Low- and High-Level Languages, Procedural and Object-Oriented Languages, Application and System Software, The Development of C Algorithms The Software Development Process.

UNIT-II:

Introduction to C Programming- Identifiers, The main () Function, The printf () Function P**rogramming Style** - Indentation, Comments, Data Types**,** Arithmetic Operations, Expression Types, Variables and Declarations, Negation, Operator Precedence and Associativity, Declaration Statements, Initialization.

Assignment - Implicit Type Conversions, Explicit Type Conversions (Casts), Assignment Variations, Mathematical Library Functions, Interactive Input, Formatted Output, Format Modifiers.

UNIT -III:

Control Flow-Relational Expressions - Logical Operators:

Selection: if-else Statement, nested if, examples, Multi-way selection: switch, else-if, examples.

Repetition: Basic Loop Structures, Pretest and Posttest Loops, Counter-Controlled and Condition- Controlled Loops, while Statement, for Statement, Nested Loops, do-while Statement.

UNIT-IV

Modular Programming: Function and Parameter Declarations, Returning a Value, Functions withEmpty Parameter Lists, Variable Scope, Variable Storage Class, Local Variable Storage Classes, Global Variable Storage Classes, Pass by Reference, Passing Addresses to a Function, Storing Addresses, Using Addresses, Declaring and Using Pointers, Passing Addresses to a Function.

Case Study: Swapping Values, Recursion - Mathematical Recursion, Recursion versus Iteration.

UNIT-V:

Arrays & Strings

Arrays: One-Dimensional Arrays, Input and Output of Array Values, Array Initialization, Arrays asFunction Arguments, Two-Dimensional Arrays, Larger Dimensional Arrays- Matrices.

Strings: String Fundamentals, String Input and Output, String Processing, Library Functions

UNIT-VI:

Pointers, Structures, Files

Pointers: Concept of a Pointer, Initialization of pointer variables, pointers as function arguments,passing by address, Dangling memory, address arithmetic, character pointers and functions,pointers to pointers, Dynamic memory management functions, command line arguments.

Structures: Derived types, Structures declaration, Initialization of structures, accessing structures,nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, bit-fields.

Data Files: Declaring, Opening, and Closing File Streams, Reading from and Writing to Text Files, Random File Access

Outcomes:

CO#	Statement	Cognitive Level
CO1	Understand the basic terminology used in computer programming	
CO2	Write, compile and debug programs in C language.	
CO3	Use different data types in a computer program.	
CO4	Design programs involving decision structures, loops and functions.	
CO5	Explain the difference between call by value and call by reference	
CO6	Understand the dynamics of memory by the use of pointers	
CO7	Use different data structures and create/update basic data files.	

Text Books:

1. ANSI C Programming, Gary J. Bronson, Cengage Learning.
2. Programming in C, B. L.Juneja, Anita Seth, Cengage Delmar Learning India Pvt.
3. The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education.

Reference Books:

1. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.
2. Programming with C, R S Bichkar, University Press, 2012.
3. Programming in C, ReemaThareja, Oxford.
4. C by Example, Noel Kalicharan, Cambridge University Press.

URLs

1. http://nptel.ac.in/courses/106104128/
2. http://students.iitk.ac.in/programmingclub/course/#notes
3. http://c-faq.com/~scs/cclass/cclass.html
4. http://www.youtube.com/watch?v=b00HsZvg-V0&feature=relmfu
5. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/

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L	T	P	C
4	0	0	3

I year - I semester

Subject Code: 16BH1T13

ENVIRONMENTAL STUDIES

UNIT – I

Course Learning Objectives: Basic understanding of the environment, global problems and ecosystems.

Course Outcomes: The importance of environment and global environmental problems. The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web.

Multidisciplinary nature of Environment and Ecology: Definition, Scope and Importance, *Introduction to Brief works of noted Environmentalists & Naturalists(Wangari Mathai,Salim Ali and Sunderlal Bahuguna)* ,Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, Carbon Credits, acid rains, ozone layer depletion, population growth and explosion, effects. Role of information Technology in Environment and human health.

Ecosystems: Concept of an ecosystem**,** Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. Classification of ecosystems- characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems: Estuaries and Mangroves

UNIT – II

Course Learning Objectives: Overall understanding of the natural resources

Course Outcomes: The natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources.

Natural Resources: Natural resources and associated problems

Forest resources – Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people

Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Sustainable mining of Granite, Laterite, Coal, Sea and River sands.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources Vs Oil and Natural Gas Extraction.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT – III

Course Learning Objectives**:** Basic understanding of Biodiversity.

Course Outcomes: The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts - Endangered and endemic species of India – Conservation of biodiversity.

UNIT – IV

Course Learning Objectives: Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities

Course Outcomes: Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, *Heavy Metal pollution*, Soil pollution, Noise pollution, Radioactive pollution: Sources and risks. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Style, Impact of Fire Crackers on Man and his well being.

Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e - waste management.

UNIT – V

Course Learning Objectives: Awareness on the social issues, environmental legislation and global treaties

Course Outcomes: Social issues both rural and urban environment and the possible means to combat the challenges. The environmental legislations of India and the first global initiatives towards sustainable development.

Social Issues and the Environment: Urban problems related to energy -Water conservation-*Coastal Regulatory zone management*, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental 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.

UNIT – VI

Course Learning Objectives: An understanding of the environmental impact of developmental activities

Course Outcomes: About environmental assessment and the stages involved in EIA and the environmental audit. Self Sustaining Green Campus with Environment Friendly aspect of – Energy, Water and Wastewater reuse Plantation, Rain water Harvesting, Parking & Curriculum.

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. *Environmental Modeling: Definition (Box Model and Gaussian Plume Modeling),* Ecotourism, Green Campus – Green business, Green

politics *and Green Building.*
The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

TEXT BOOKS:

1. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
2. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
3. Environmental Studies, P.N. Palanisamy, P. Manikandan, A. Geetha, and K.Manjula Rani; Pearson Education, Chennai

REFERENCE:

1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014
5. Environmental pollution, Monitoring and Control by Khopkar.S.M, New Age Publishers.
6. *A Text Book of Fundamentals of Ecology, E.P.Odam, Philadelphia: W.B. Saunders Company.*

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L	T	P	C
4	0	0	3

I year - I semester
Subject Code: 16BH1L05

ENGINEERING/APPLIED CHEMISTRY LAB

1. Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis, Quantitative analysis etc.,
2. Trial experiment – Estimation of HCI using standard Na2co2 solutions
3. Estimation of KMnO4 using standard Oxalic acid solution.
4. Estimation of Ferric iron using standard K2Cr2O7 solution
5. Estimation of Copper using standard K2Cr2O7 solution.
6. Estimation of Total Hardness water using standard EDTA solution.
7. Estimation of Copper using standard EDTA solution.
8. Estimation of Copper using Colorimeter
9. Estimation of pH of the given sample solution using pH meter.
10. Conductometric Titrations between strong acid and strong base
11. Conductometric Titrations between strong acid and Weak base
12. Potentiometric Titrations between strong acid and strong base
13. Potentiometric Titrations between strong acid and Weak base
14. Estimatinog of Zinc using standard potassium ferrocyanide solution
15. Estimation of Vitamin – C

STANDARD BOOKS :

1. Dr.Jyotsna Cherukuis(2012)Laboratory Manual of Engineering Chemistry-II, VGS Techno Series

2. Chemistry Practical Manual, Lorven Publications

3. K. Mukkanti (2009) Practical Engineering Chemistry, B.S. Publication

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L	T	P	C
0	0	3	2

I Year - I Semester

Subject Code:16BH1L01

ENGLISH - COMMUNICATION SKILLS LAB- I

PRESCRIBED LAB MANUAL FOR SEMESTER I:

'INTERACT: English Lab Manual for Undergraduate Students', Published by Orient Black swan Pvt Ltd.

Objectives:

To enable the students to learn through practice the communication skills of listening, speaking, reading and writing.

Outcome:

A study of the communicative items in the laboratory will help the students become successful in the competitive world. The course content along with the study material is divided into six units.

UNIT 1:

1. WHY study Spoken English?
2. Making Inquiries on the phone, thanking and responding to Thanks -- Practice work.

UNIT 2:

1. Responding to Requests and asking for Directions -- Practice work.

UNIT 3:

1. Asking for Clarifications, Inviting, Expressing Sympathy, Congratulating
2. Apologising, Advising, Suggesting, Agreeing and Disagreeing -- Practice work.

UNIT 4:

1. Letters and Sounds -- Practice work.

UNIT 5:

1. The Sounds of English -- Practice work.

UNIT 6:

1. Pronunciation
2. Stress and Intonation -- Practice wor

Reference Books:

1. Strengthen your communication skills by Dr M Hari Prasad, Dr Salivendra Raju and Dr G Suvarna Lakshmi, Maruti Publications.
2. English for Professionals by Prof Eliah, B.S Publications, Hyderabad.
3. Unlock, Listening and speaking skills 2, Cambridge University Press
4. Spring Board to Success, Orient BlackSwan
5. A Practical Course in effective english speaking skills, PHI
6. Word power made handy, Dr shalini verma, Schand Company
7. Let us hear them speak, Jayashree Mohanraj, Sage texts
8. Professional Communication, Aruna Koneru, Mc Grawhill Education
9. Cornerstone, Developing soft skills, Pearson Education

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I Year - I Semester

Subject Code:16CS1L10

C PROGRAMMING LAB

OBJECTIVES:

- Understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures a File programming.
- Acquire knowledge about the basic concept of writing a program.
- Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
- Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.
- Role of Functions involving the idea of modularity.

Programming

Exercise - 1 Basics
a) What is an OS Command, Familiarization of Editors - vi, Emacs
b) Using commands like mkdir, ls, cp, mv, cat, pwd, and man
c) Write a C Program to perform Adding, Subtraction, Multiplication and Division of two numbers from Command line

Exercise - 2 Basic Math
a) Write a C Program to Simulate 3 Laws at Motion
b) Write a C Program to convert Celsius to Fahrenheit and vice versa

Exercise - 3 Control Flow - I
a)Write a C Program to Find Whether the Given Year is a Leap Year or not.
b)Write a C Program to Add Digits & Multiplication of a number

Exercise – 4 Control Flow - II
a) Write a C Program to Find Whether the Given Number is
   i. Prime Number
   ii. Armstrong Number
b) Write a C program to print Floyd Triangle
c) Write a C Program to print Pascal Triangle

Exercise – 5 Functions
a) Write a C Program demonstrating of parameter passing in Functions and returning values.
b) Write a C Program illustrating Fibonacci, Factorial with Recursion without Recursion

Exercise – 6 Control Flow - III

a) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide Using switch…case

b) Write a C Program to convert decimal to binary and hex (using switch call function the function)

Exercise – 7 Functions - Continued

Write a C Program to compute the values ofsin x and cos x and e^x values using Series expansion. (use factorial function)

Exercise – 8 Arrays

Demonstration of arrays

a) Search-Linear.
b) Sorting-Bubble, Selection.
c) Operations on Matrix.

Exercises - 9 Structures

a)Write a C Program to Store Information of a Movie Using Structure

b)Write a C Program to Store Information Using Structures with Dynamically Memory Allocation

c) Write a C Program to Add Two Complex Numbers by Passing Structure to a Function

Exercise - 10 Arrays and Pointers

a) Write a C Program to Access Elements of an Array Using Pointer

b) Write a C Program to find the sum of numbers with arrays and pointers.

Exercise – 11 Dynamic Memory Allocations

a) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.

b) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

Understand the difference between the above two programs.

Exercise – 12 Strings

a) Implementation of string manipulation operations **with** library function.

i) copy
ii) concatenate
iii) length
iv) compare

b) Implementation of string manipulation operations **without** library function.

i) copy
ii) concatenate
iii) length
iv) compare

Exercise -13 Files
a) Write a C programming code to open a file and to print it contents on screen.
b) Write a C program to copy files

Exercise - 14 Files Continue
a) Write a C program merges two files and stores their contents in another file.
b) Write a C program to delete a file.

OUTCOMES:

CO#	Statement	Cognitive Level
CO1	Apply and practice logical ability to solve the problems.	
CO2	Understand C programming development environment, compiling, debugging, and linking and executing a program using the development environment	
CO3	Analysing the complexity of problems, Modularize the problems into small modules and then convert them into programs	
CO4	Understand and apply the in-built functions and customized functions for solving the problems.	
CO5	Understand and apply the pointers, memory allocation techniques and use of files for dealing with variety of problems.	
CO6	Document and present the algorithms, flowcharts and programs in form of user-manuals	
CO7	Identification of various computer components, Installation of software	

Note:

a) All the Programs must be executed in the Linux Environment. (Mandatory)
b) The Lab record must be a print of the LATEX (.tex) Format.

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L	T	P	C
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I year - II semester

Subject Code: 16BH2T02

ENGLISH-II

Introduction:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training the students have to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of the students of Engineering.

As far as the detailed Textbooks are concerned, the focus should be on the skills of listening, speaking, reading and writing. The non-detailed Textbooks are meant for extensive reading for pleasure and profit. Thus the stress in the syllabus in primarily on the development of communicative skills and fostering of ideas.

Objectives:

1. To improve the language proficiency of the students in English with emphasis on LSRW skills.
2. To enable the students to study and comprehend the prescribed lessons and subjects more effectively relating to their theoretical and practical components.
3. To develop the communication skills of the students in both formal and informal situations.

LISTENING SKILLS

Objectives:

1. To enable the students to appreciate the role of listening skill and improve their pronunciation.
2. To enable the students to comprehend the speech of people belonging to different backgrounds and regions.
3. To enable the students to listen for general content, to fill up information and for specific information.

SPEAKING SKILLS

Objectives:

1. To make the students aware of the importance of speaking for their personal and professional communication.
2. To enable the students to express themselves fluently and accurately in social and professional success.
3. To help the students describe objects, situations and people.
4. To make the students participate in group activities like role-plays, discussions and debates.
5. To make the students participate in Just a Minute talks

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READING SKILLS

Objectives:

1. To enable the students to comprehend a text through silent reading.
2. To enable the students to guess the meanings of words, messages and inferences of texts in given contexts.
3. To enable the students to skim and scan a text.
4. To enable the students to identify the topic sentence.
5. To enable the students to identify discourse features.
6. To enable the students to make intensive and extensive reading.

WRITING SKILLS

Objectives:

1. To make the students understand that writing is an exact formal skills.
2. To enable the students to write sentences and paragraphs.
3. To make the students identify and use appropriate vocabulary.
4. To enable the students to narrate and describe.
5. To enable the students capable of note-making.
6. To enable the students to write coherently and cohesively.
7. To make the students to write formal and informal letters.
8. To enable the students to describe graphs using expressions of comparison.
9. To enable the students to write technical reports.

Methodology:

1. The classes are to be learner-centred where the learners are to read the texts to get a comprehensive idea of those texts on their own with the help of the peer group and the teacher.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The tasks/exercises at the end of each unit should be completed by the learners only and the teacher intervention is permitted as per the complexity of the task/exercise.
4. The teacher is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The teacher is permitted to use lecture method when a completely new concept is introduced in the class.

The following text books are recommended for study in I B.Tech II Semester (Common for all branches) of Pragati Engineering College, Surampalem from the academic year 2016-17 (R-16 Regulations)

DETAILED TEXTBOOK:

- *ENGLISH ENCOUNTERS Published by Maruthi Publishers.*

- A BETTER INDIA, A BETTER WORLD by N.R. Narayana Murthy,Published by: Penguin Books India Pvt. Ltd.

DETAILED NON-DETAIL:

- *THE GREAT INDIAN SCIENTISTS, Published by Cengage learning*

The course content along with the study material is divided into six units.

UNIT 1:

1. ' The Greatest Resource- Education' from English Encounters

Objective:
Schumacher describes the education system by saying that it was mere training, something more than mere knowledge of facts.
Outcome:
The lesson underscores that the ultimate aim of Education is to enhance wisdom.

2. ' A P J Abdul Kalam' from The Great Indian Scientists.

Objective:
The lesson highlights Abdul Kalam's contributions to Indian science and the awards he received.
Outcome:
Abdul Kalam's simple life and service to the nation inspires the readers to follow in his footsteps.

UNIT 2:

1. ' A Dilemma' from English Encounters

Objective:
The lesson centres on the pros and cons of the development of science and technology.
Outcome:
The lesson enables the students to promote peaceful co-existence and universal harmony among people and society.

2. 'C V Raman' from The Great Indian Scientists.

Objective:
The lesson highlights the dedicated research work of C V Raman and his achievements in Physics.

Outcome:
The Achievements of C V Raman are inspiring and exemplary to the readers and all scientists.

UNIT 3:

Unit 3 has two sections: Unit 3(A) and 3(B)

3 (A)

1. 'Cultural Shock': Adjustments to new Cultural Environments from English Encounters.

Objective:

The lesson depicts of the symptoms of Cultural Shock and the aftermath consequences

Outcome:

The lesson imparts the students to manage different cultural shocks due to globalization.

2. 'Homi Jehangir Bhabha' from The Great Indian Scientists.

Objective:

The lesson highlights Homi Jehangir Bhabha's contributions to Indian nuclear program as architect.

Outcome:

The seminal contributions of HomiJehangirBhabha to Indian nuclear program provide an aspiration to the readers to serve the nation and strengthen it.

Unit 3 (B)

1.'What can we learn from West?' from A Better India, A Better World

Objective:

To enable students to appreciate the differences in cultural perspectives.

Outcome:

This lesson motivates students to develop a multicultural outlook and appreciate the diverse cultures.

UNIT 4:

1. 'The Lottery' from English Encounters.

Objective:

The lesson highlights insightful commentary on cultural traditions.

Outcome:

The theme projects society's need to re examine its traditions when they are outdated.

2. 'Jagadish Chandra Bose' from The Great Indian Scientists.

Objective:

The lesson gives an account of the unique discoveries and inventions of Jagadish Chandra Bose in Science.

Outcome:

The Scientific discoveries and inventions of Jagadish Chandra Bose provide inspiration to the readers to make their own contributions to science and technology, and strengthen the nation.

UNIT 5:

1. ' The Health Threats of Climate Change' from English Encounters.

Objective:

The essay presents several health disorders that spring out due to environmental changes

Outcome:

The lesson offers several inputs to protect environment for the sustainability of the future generations.

2. ' Prafulla Chandra Ray' from The Great Indian Scientists.

Objective:

The lesson given is an account of the experiments and discoveries in Pharmaceuticals of Prafulla Chandra Ray.

Outcome:

Prafulla Chandra Ray's scientific achievements and patriotic fervour provide inspiration to the reader.

UNIT 6:

1. ' The Chief Software Architect' from English Encounters

Objective:

The lesson supports the developments of technology for the betterment of human life.

Outcome:

Pupil gets inspired by eminent personalities who toiled for the present day advancement of software development.

2. ' Srinivasa Ramanujan' from The Great Indian Scientists.

Objective:

The lesson highlights the extraordinary achievements of Srinivasa Ramanujan, a great mathematician and the most romantic figure in mathematics.

Outcome:

The lesson provides inspiration to the readers to think and tap their innate talents

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I year - II semester

Subject Code: 16BH2T04

MATHEMATICS – II
(Mathematical Methods)

Course Objectives:

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

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

CO#	Statement	Cognitive Level
CO1	Solve the algebraic and transcendental equation by using numerical methods.	
CO2	Finding the required functional value using interpolation formulae with equal and unequal intervals.	
CO3	Evaluate the given integral using numerical methods by different formulae.	
CO4	Express the given function into Fourier series in the given interval. Find sine and cosine series in the given interval.	
CO5	Find the Fourier integral and transforms of a given function and Fourier sin and cosine transform of a given function.	
CO6	Find the partial derivative by elimination of arbitrary function and arbitrary constant. Solve the liner and non-liner PDEs.	

UNIT I: Solution of Algebraic and Transcendental Equations

Introduction- Bisection method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations).

UNIT II: Interpolation

Introduction- Errors in polynomial interpolation – Finite differences- Forward differences-Backward differences –Central differences – Symbolic relations and separation of symbols - Differences of a polynomial-Newton's formulae for interpolation – Interpolation with unequal intervals - Lagrange's interpolation formula.

UNIT III: Numerical Integration and solution of Ordinary Differential equations

Trapezoidal rule- Simpson's 1/3rd and 3/8th rule-Solution of ordinary differential equations by Taylor's seriesPicard's method of successive approximations-Euler's method - Runge-Kutta method (second and fourth order).

UNIT IV: Fourier Series

Introduction- Periodic functions – Fourier series of -periodic function - Dirichlet's conditions – Even and odd functions –Change of interval– Half-range sine and cosine series.

UNIT V: Fourier Transforms

Fourier integral theorem (without proof) – Fourier sine and cosine integrals - sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT VI: Partial Differential Equations

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations. Classification of second order partial differential equations.

Applications: Method of separation of Variables- Solution of One dimensional Wave, Heat and twodimensional Laplace equations.

Text Books:

1. **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **N.P.Bali**, Engineering Mathematics, Lakshmi Publications.
3. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.

Reference Books:

1. **Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
2. **V.Ravindranath**and **P.Vijayalakshmi**, Mathematical Methods, Himalaya Publishing House.
3. **David Kincaid, Ward Cheney**, Numerical Analysis-Mathematics of Scientific Computing, 3rd Edition, Universities Press.
4. **Srimanta Pal, SubodhC.Bhunia**, Engineering Mathematics, Oxford University Press.
5. **Dass H.K., RajnishVerma. Er.**, Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

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I year - II semester

Subject Code: 16BH2T06

MATHEMATICS – III

Course Objectives:

1. The course is designed to equip the students with the necessary mathematical skillsand techniques that are essential for an engineering course.
2. The skills derived from the course will help the student from a necessary base todevelop analytic and design concepts.
3. Understand the most basic numerical methods to solve simultaneous linear equations.

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

CO#	Statement	Cognitive Level
CO1	Find the Laplace transform of functions and evaluation of integrals.	
CO2	Find the inverse Laplace transform of different functions and solve the differential equations using Laplace transform.	
CO3	Tracing the curve for the given equation evaluate the double and triple integrals by direct method change of order of integration and change of variables.	
CO4	Evaluate the given integrals by using Beta and Gamma functions.	
CO5	Find the gradient of a scalar filed, divergence and curl of vector filed and vector identities.	
CO6	Evaluate the line, surface and volume integrals. Solve the problems using vector integral theorems.	

UNIT I: Laplace transforms

Laplace transforms of standard functions-Shifting theorems - Transforms of derivatives and integrals – Unit step function –Dirac's delta function.

UNIT II: Inverse Laplace transforms

Inverse Laplace transforms – Shifting Theorems - Transforms of derivatives and integrals - Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT III: Multiple integrals
Curve tracing: Cartesian, Polar and Parametric forms.
Multiple integrals: Double and triple integrals – Change of variables – Change of order of integration.
Applications: Finding Areas and Volumes.

UNIT IV: Special functions
Beta and Gamma functions- Properties - Relation between Beta and Gamma functions -Evaluation of improper integrals.
Applications: Evaluation of integrals.

UNIT V: Vector Differentiation
Gradient- Divergence- Curl - Laplacian and second order operators -Vector identities.
Applications: Equation of continuity, potential surfaces

UNIT VI: Vector Integration
Line integral – Work done – Potential function – Area- Surface and volume integrals
Vectorintegral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) andrelated problems.
Applications: Work done, Force.

Text Books:

1. **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **N.P.Bali**, Engineering Mathematics, Lakshmi Publications.
3. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

Reference Books:

1. **Greenberg**, Advanced Engineering Mathematics, 2nd edition, Pearson edn
2. **Peter O'Neil**, Advanced Engineering Mathematics,7th edition, Cengage Learning.
3. **D.W. Jordan and T.Smith**, Mathematical Techniques, Oxford University Press.
4. **Srimanta Pal, SubodhC.Bhunia**, Engineering Mathematics, Oxford University Press.
5. **Dass H.K., RajnishVerma. Er.**, Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

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I year - II semester

Subject Code: 16BH2T09

ENGINEERING PHYSICS

COURSE OBJECTIVES: Physics curriculum which is re-oriented to the needs of non Circuital branches of graduate engineering courses.. That serves as a transit to understand the branch specific advanced topics. The courses are designed to:

• Impart concepts of Optical Interference, Diffraction and Polarization required to design instruments with higher resolution - Concepts of coherent sources, its realization and utility optical instrumentation.

• Study the Structure-property relationship exhibited by solid crystal materials for their utility.

• Tap the Simple harmonic motion and its adaptability for improved acoustic quality of concert halls.

• To explore the Nuclear Power as a reliable source required to run industries

• To impart the knowledge of materials with characteristic utility in appliances.

UNIT-I

Objective: To impart knowledge on interference phenomenon and utilising it to design of instruments in Engineering applications.

Outcome: The students will learn to apply the concepts of interference undergo analysis of optical effects and contribute to engineering applications.

INTERFERENCE: Introduction-Principle of Superposition – Coherent Sources – Interference in thin films (reflection geometry)- Interference in wedge shaped films – Newton's rings –working principle of Interferometer, applications

UNIT-II

Objective: To impart knowledge on diffraction phenomenon to design optical instruments for Engineering applications.

Outcome: The students will learn to study diffraction pattern of light to utilize in the analysis of the materials and their properties.

DIFFRACTION: Introduction -Fraunhoffer diffraction at single slit - Cases of double slit, N-slits & Circular Aperture (Qualitative treatment only)-Grating equation - Resolving power of a grating, Telescope and Microscopes- applications.

UNIT-III

Objective:

- **To impart knowledge on types of polarization, types of polarizing materials and their effects to study and design of optical instruments.**
- **To impart knowledge on the lasers & their working principle**

Outcome: The students will learn polarization phenomenon, Lasers and their practical implications in engineering applications.

POLARIZATION: Introduction -Types of Polarization – Methods of production – double refraction-Nicol Prism -Quarter wave plate and Half Wave plate – Working principle of Polari meter (Sacharimeter)-applications.

LASERS: Introduction- Characteristics– Stimulated emission – Einstein's Transition Probabilities- Pumping schemes - Ruby laser – Helium Neon laser-applications of lasers

UNIT-IV

Objective: To impart knowledge on fundamentals of acoustic principles & methods of production of Ultrasonic waves and study their practical applications.

Outcome: The student will learn the basics of architectural acoustics for structural designing & production of Ultrasonic waves for practical applications.

ACOUSTICS: Introduction- Acoustics of concert hall- -. Reverberation time – Sabine's formula - Absorption Coefficient and its Measurement- Effecting factors and Remedies.

ULTRASONICS: Introduction -Production by Magnetostriction & Piezo electric effect- Detection Methods- Ultrasonic transducers -Non Destructive Testing-Applications.

UNIT-V

Objective: To impart knowledge on study of structure of materials, property relationship exhibited by the solid state materials for their utility and to explore the nuclear power as a reliable source required to run industries

Outcomes.

- **The students will learn the structures and properties of solid state materials.**
- **The students will learn the fundamentals of Nuclear Physics & production of nuclear energy using technology.**

CRYSTALLOGRAPHY & X-RAY DIFFRACTION: Introduction-Basis and lattice – Unit cell - Coordination number -Bravais lattice-Crystal Systems- Packing fractions –Crystal directions and planes-Miller indices – Separation between successive (h k l) planes – Bragg's law - Bragg's X-ray spectrometer.

NUCLEAR ENERGY – SOURCE OF POWER: Mass defect & Binding Energy – Fusion and Fission as sources – Fast breeder Reactors.

UNIT-VI

Objective: To impart knowledge on materials with characteristic utility in appliances.

Outcome: The students will learn effects of magnetic & dielectric properties of materials & will apply such materials in various applications of engineering.

MAGNETISM: Introduction-Basics of Magnetism-Origin of Magnetic Moment -Classification of Magnetic Materials- Weiss theory-Domain Theory-Hysteresis- Eddy Current Losses- -Hard and soft Magnetic materials- applications

DIELECTRICS: Electric Polarization – Dielectrics in DC and AC fields – Internal field – Clausius -Mosotti Equation - Loss, Breakdown and strength of dielectric materials – Ferroelectric Hysteresis and applications.

COURSE OUTCOME: Construction and working details of instruments, ie., Interferometer, Diffract meter and Polarimeter are learnt. Study Acoustics, crystallography magnetic and dielectric materials enhances the utility aspects of materials.

Text Books:

1. A Text book of Engineering Physics – by Dr. M.N.Avadhanulu and Dr.P.G.Kshirasagar, S.Chand & Company Ltd., (2014)
2. Physics for Engineers by M.R.Srinasan, New Age international publishers (2009)

Reference books:

1.Physics by Resnick,Halliday&Krane ,Volume I&II ,John Wiley&sons(2002)
2. Engineering Physics by D.K.Bhattacharya and Poonam Tandon , Oxford press (2015)
3. Applied Physics by P.K.Palanisamy , Scitech publications (2014)
4. Lasers and Non-Linear optics by B.B.Laud , Newage international publishers (2008

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I year - II semester

Subject Code: 16EE2T03

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Preamble:

This course covers the topics related to analysis of various electrical circuits, operation of various electrical machines, various electronic components to perform well in their respective fields.

Learning Objectives:

- To learn the basic principles of electrical circuital law's and analysis of networks.
- To understand the principle of operation and construction details of DC machines & Transformers.
- To understand the principle of operation and construction details of alternator and 3-Phase induction motor.
- To study the operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
- To learn the operation of PNP and NPN transistors and various amplifiers.

Unit - I
Electrical Circuits:

Basic definitions - Types of network elements - Ohm's Law - Kirchhoff's Laws - Inductive networks - Capacitive networks – Series - Parallel circuits - Star-delta and delta-star transformations.

Unit - II
DC Machines:

Principle of operation of DC generator – EMF equation - Types of DC machine – Torque equation – Applications – Three point starter - Speed control methods of DC motor – Swinburne's Test.

Unit - III
Transformers:

Principle of operation and construction of single phase transformers – EMF equation – Losses – OC & SC tests - Efficiency and regulation.

Unit - IV
AC Rotating Machines:

Principle of operation and construction of alternators– Types of alternators – Principle of operation of 3-Phase induction motor – Slip-torque characteristics - Efficiency – Applications. Principle of operation of synchronous motor

Unit V
Semiconductor Devices and Applications:

PN junction diodes - Diode applications (Half wave and bridge rectifiers) PNP and NPN junction transistor, transistor as an amplifier- Transistor amplifier. Frequency response of CE amplifier - Concepts of feedback amplifier. Transistor applications.

Unit VI
Linear IC's and Applications:

Introduction to Operational Amplifiers- Characteristics of Operational amplifiers (OP-AMP) - application of OP-AMPs as inverting, non-inverting, integrator and differentiator. Introduction to Thyristor.

Learning Outcomes:

- Able to analyse the various electrical networks.
- Able to understand the operation of DC generators,3-point starter and DC machine testing by Swinburne's Test.
- Able to analyse the performance of single-phase transformer.
- Able to explain the operation of 3-phase alternator and 3-phase induction motors.
- Able to analyse the operation of half wave, full wave bridge rectifiers and OP-AMPs.
- Able to explain the single stage CE amplifier and concept of feedback amplifier.

Text Books:

1. Electrical Technology by Surinder Pal Bali, Pearson Publications.

2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

Reference Books:

1.Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group
2. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMH Publications
3.Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition
4.Basic Electrical Engineering by Nagsarkar,Sukhija, Oxford Publications,2nd edition
5.Industrial Electronics by G.K. Mittal, PHI.
6. Problems of Electrical Engineering by Parkers Smith,9th Edition, CBS Publications.
7. http://www.ncert.nic.in/html/learning_basket/electricity/electricity/machine/motor.html
8.www.electricaleasy.com
9. www.nptel.ac.in/courses/108108076/

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I year - II semester

Subject Code: 16ME2T02

ENGINEERING DRAWING

Objective: Engineering drawing being the principle method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Unit I

Objective: To introduce the students to use drawing instruments and to draw polygons, Engineering Curves.

Polygons: Constructing regular polygons by general methods, inscribing and describing polygons on circles.

Curves: Parabola, Ellipse and Hyperbola by general methods, cycloids, involutes, tangents & normals for the curves.

Unit II

Objective: To introduce the students to use scales and orthographic projections, projections of points.

Scales: Plain scales, diagonal scales and vernier scales

Orthographic Projections: Horizontal plane, vertical plane, profile plane, importance of reference lines, projections of points in various quadrants. Projections of lines, lines parallel either to the reference planes (HP, VP or PP)

Unit III

Objective: The objective is to make the students draw the projections of simple lines inclined to one or both the planes.

Projections of lines inclined to both the planes, determination of true lengths, angle of inclination and traces- HT, VT.

Unit IV

Objective: The objective is to make the students draw the projections of the plane inclined to both the planes.

Projections of planes: regular planes perpendicular/parallel to one plane and inclined to the other reference plane; inclined to both the reference planes.

Unit V

Objective: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes.

Unit VI

Objective: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Conversion of isometric views to orthographic views, Conversion of orthographic views to isometric views.

TEXT BOOKS:

1. Engineering Drawing by N.D. Bhatt, Chariot Publications
2. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age International

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers
5. http://nptel.ac.in/courses/112103019/
6. http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html
7. http://www.engineeringdrawing.org

Course Outcomes:

CO#	Statement	Cognitive Level
CO1	Provides the students with a background in descriptive geometry, orthographic & isometric projection, engineering drawing techniques. Points, lines and plane relationships in projection, multi-view engineering drawings, basic dimensioning, engineering applications.	
CO2	Student's ability to perform basic sketching techniques will improve. Students will be able to draw orthographic projections.	
CO3	Student's ability to convert sketches to engineered drawings will increase.	

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I year - II semester

Subject Code: 16BH2L02

ENGLISH - COMMUNICATION SKILLS LAB- II

PRESCRIBED LAB MANUAL FOR SEMESTER II:
'INTERACT: English Lab Manual for Undergraduate Students' Published by Orient Blackswan Pvt Ltd.

OBJECTIVES: To enable the students to learn demonstratively the communication skills of listening, speaking, reading and writing.

OUTCOME: A study of the communicative items in the laboratory will help the students become successful in the competitive world.

The course content along with the study material is divided into six units.

UNIT-1:

1.Debating- Practice work

UNIT-2:

1.Group Discussion- Practice work

UNIT-3:

1.Presentation Skills- Practice work

UNIT-4:

1.Interview Skills- Practice work

UNIT-5:

1.Email
2.Curriculum Vitae- Practice work

UNIT-6:

1.Idiomatic Expressions
2.Common Errors in English- Practice work

Reference Books:

1. Strengthen your communication skills by Dr M Hari Prasad, Dr Salivendra Raju and Dr G Suvarna Lakshmi, Maruti Publications.
2. English for Professionals by Prof Eliah, B.S Publications, Hyderabad.
3. Unlock, Listening and speaking skills 2, Cambridge University Press
4. Spring Board to Success, Orient BlackSwan
5. A Practical Course in effective english speaking skills, PHI
6. Word power made handy, Dr shalini verma, Schand Company
7. Let us hear them speak, Jayashree Mohanraj, Sage texts
8. Professional Communication, Aruna Koneru, Mc Grawhill Education
9. Cornerstone, Developing soft skills, Pearson Education

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L	T	P	C
0	0	3	2

I year - II semester

Subject Code: 16BH2L03

ENGINEERING/APPLIED PHYSICS LAB

(only 10 out of 14 Experiments prescribed)

1. To verify the Laws of Transverse vibrations of a stretched string using sonometer
2. To determine the Rigidity Modulus of a given wire using Torsional Pendulum
3. To determine the velocity of sound in air using Volume Resonator Method
4. To determine the acceleration due to gravity using Compound Pendulum
5. To determine the frequency of an electric tuning fork using Melde's Apparatus
6. To Study the V-I Characteristics and determine the breakdown voltage of a Zener Diode
7. To determine the wavelength of a given source using diffraction Grating in Normal Incidence Method
8. To determine the energy Band Gap of a Semiconductor using P-N Junction diode
9. To Study the variation of the Magnetic field along the axis of a current carrying circular coil using Stewart and Gee's Apparatus
10. To study the R-I Characteristics of a Themistor
11. To determine the refractive index of the medium of the film using the formation of Newton's Rings.
12. To determine the thickness of a paper using the formation of parallel fringes
13. To Determine Planck's constant using photoconductor
14. To determine the refractive index of the Prism using spectrometer

Reference :

1. Engineering Physics Lab Manual by Dr.Y.Aparna & Dr.K.Venkatesswara Rao.(V.G.S. Book Links)
2. Physics Manual cum Observation book (College Designed Manual).

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L	T	P	C
0	0	2	0

I year - II semester

Subject Code: 16BH2L04

ENGINEERING/APPLIED PHYSICS-VIRTUAL LAB ASSIGNMENTS

(Constitutes 5 marks of 40 marks of Internal-component)

List of Experiments
1. Hall Effect
2. Crystal Structure
3. Hysteresis
4. Brewster's angle
5. Numerical Aperture of Optical fiber
6. Photoelectric Effect
7. Simple Harmonic Motion
8. LASER – Beam Divergence and Spot size
9. B-H curve
10. Michelson's interferometer

URL: www.vlab.co.in

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L	T	P	C
0	0	3	2

I year - II semester

Subject Code: 16ME2L01

ENGINEERING WORKSHOP

Course Objective: To impart hands-on practice on basic engineering trades and skills.
Note: At least two exercises to be done from each trade.
Trade:

Carpentry
1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint
4. Mortise and Tenon Joint

Fitting
1. V Fit
2. Square Fit
3. Half Round Fit
4. Dovetail Fit

Black Smithy
1. Round rod to Square
2. S-Hook
3. Round Rod to Flat Ring
4. Round Rod to Square headed bolt

House Wiring
1. Parallel / Series Connection of three bulbs
2. Stair Case wiring
3. Florescent Lamp Fitting
4. Measurement of Earth Resistance

Tin Smithy
1. Taper Tray
2. Square Box without lid
3. Open Scoop
4. Funnel

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IT WORKSHOP

OBJECTIVES:

- Understand the basic components and peripherals of a computer.
- To become familiar in configuring a system.
- Learn the usage of productivity tools.
- Acquire knowledge about the netiquette and cyber hygiene.
- Get hands on experience in trouble shooting a system?

1. **System Assembling, Disassembling and identification of Parts / Peripherals**
2. **Operating System Installation**-Install Operating Systems like Windows, Linux along with necessary Device Drivers.
3. **MS-Office / Open Office**
    a. **Word** - Formatting, Page Borders, Reviewing, Equations, symbols.
    b. **Spread Sheet** - organize data, usage of formula, graphs, charts.
    c. **Power point** - features of power point, guidelines for preparing an effective presentation.
    d. **Access**- creation of database, validate data.
4. **Network Configuration & Software Installation**-Configuring TCP/IP, proxy and firewall settings. Installing application software, system software & tools.
5. **Internet and World Wide Web**-Search Engines, Types of search engines, netiquette, cyber hygiene.
6. Trouble Shooting-Hardware trouble shooting, Software trouble shooting.
7. **MATLAB-** basic commands, subroutines, graph plotting.
8. **LATEX**-basic formatting, handling equations and images.

Outcomes:

CO#	Statement	Cognitive Level
CO1	PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers.	
CO2	Internet & World Wide Web introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet.	

CO3	Usage of web browsers, email, newsgroups and discussion forums, awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber attacks will be introduced.	
CO4	Productivity tools will enable the students in crafting professional word documents, excel spread sheets and power point presentations using the Microsoft suite of office tools and LaTeX.	
CO5	Basic usage of MATLAB toolboxes will be introduced.	

Text Books:

1. Computer Hardware, Installation, Interfacing, Troubleshooting and Maintenance, K.L. James, Eastern Economy Edition.
2. Microsoft Office 2007: Introductory Concepts and Techniques, Windows XP Edition by Gary B. Shelly, Misty E. Vermaat and Thomas J. Cashman (2007, Paperback).
3. LATEX- User's Guide and Reference manual, Leslie Lamport, Pearson, LPE, 2/e.
4. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, Rudraprathap, Oxford University Press, 2002.
5. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson, 2008
6. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech.
7. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech.
8. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year I semester -16ME3T04

METALLURGY & MATERIALS SCIENCE

***Course Objective**:*

To understand the basic fundamentals of Material science and Physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

Course Outcome:

On the completion of this course student gets a thorough knowledge of construction and micro configuration of all engineering materials which aids in material selection in designs and selection of manufacturing process to optimize the costs.

UNIT – I

***Learning Objective:** To know the basic concepts of bonds in metals and alloys. To understand the basic requirements for the formation of solid solutions and other compounds.*

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

***Learning Outcome*:** *Given a type of material be able to qualitatively describe the bonding scheme and its general physical Properties, as well as possible applications. Given a type of bond, be able to describe its physical origin, as well as strength.*

UNIT –II

***Learning Objective:** To understand the regions of stability of the phases that can occur in an alloy system in order to solve the problems in practical metallurgy.*

Equilibrium Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphism 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-, Bi-Cd and Fe-Fe3C.

***Learning Outcome:** Given a binary phase diagram, what microstructures can be obtained by suitable thermal treatments examples for near-equilibrium and far-from-equilibrium processing and suitable temperatures and their material composition.*

UNIT –III

Learning Objective: *To study the basic differences between cast irons and steels, their properties and practical applications.*

Cast Irons and Steels: 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.

Learning Outcome: *The ability to integrate understanding of the scientific and engineering principles underlying the four major elements: structure, properties, processing, and performance related to material systems appropriate to the field.*

UNIT – IV

Learning Objective: *To study the affect of various alloying elements on iron-iron carbide system. To understand the various heat treatment and strengthening processes used in practical applications.*

Heat treatment of Alloys: Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Harden ability, surface - hardening methods, Age hardening treatment.

Learning Outcome: *The ability to learn about the necessity of heat treatment process to the materials and their temperature indications, strengthening of metals and alloys, suitable temperature is indicates age of the materials.*

Learning Objective: *To study the properties and applications of widely used non-ferrous metals and alloys so as to use the suitable material for practical applications.*

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys.

Learning Outcome: *The ability to learn about the various types, properties and applications of materials along with their compositions.*

UNIT – VI

Learning Objective: *To study the properties and applications of ceramic, composite and other advanced materials so as to use the suitable material for practical applications.*

Ceramic and composite materials: Crystalline ceramics, glasses, cremates, abrasive materials, nonmaterial‟s – definition, properties and applications of the above.
Classification of composites, various methods of component manufacture of composites Hand and man layup process, Filament winding process, Continuous pultrusion process, particle – reinforced materials, fiber reinforced materials, metal – matrix composites and C – C composites.

Learning Outcome: *The ability to learn about the importance of ceramics glasses and other materials like composites, their manufacturing process, and applications in daily life.*

TEXT BOOKS:

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R.Askeland - Thomson.

REFERENCES:

1. Material Science and Metallurgy – Dr. V.D.kodgire.
2. Materials Science and engineering - Callister & Baalasubrahmanyam
3. Material Science for engineering students – Fischer – Elsevier Publishers.
4. Material science and Engineering - V. Rahghavan
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press.
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications.
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publications
8. http://nptel.ac.in/courses/113105024/7.
9. http://nptel.ac.in/courses/112104122/12.
10. http://nptel.ac.in/courses/113106031/17.
11. http://nptel.ac.in/courses/113104068/36.
12. http://nptel.ac.in/courses/113104059/.
13. http://nptel.ac.in/courses/113105021/
14. http://nptel.ac.in/courses/113105021/20
15. http://nptel.ac.in/courses/113105015/3
16. http://nptel.ac.in/courses/103106108/30
17. http://nptel.ac.in/courses/112107078/12

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year I semester -16ME3T05

L	T	P	C
4	0	0	3

MECHANICS OF SOLIDS

Course Objective:

The students completing this course are expected to understand the basic terms like stress, strain, poissons ratio…etc. Assess stresses, strains and deformations through mathematical models of axial bars, beams, twisting bars, pressure vessels etc. Understand the basic mechanical principles underlying modern approaches for design of various types of structural members subjected to axial load, torsion, bending, and transverse shear and combined loading. Different stresses induced in beams, thin cylinders, thick cylinders, columns and different cross sectional members like T, C, I sections etc., further, the student shall be able to understand the shear stresses in circular shafts.

Course Outcome:

Design and conduct experiments on mechanical testing and also could analyze and interpret data. Design a component to meet desired needs. Analyze the state of stress and strain at any point in a member. Identify, formulate, and solve structural engineering problems. Learn modern experimental techniques, concepts and tools in mechanical testing of materials.

UNIT – I

Learning Objective: *To calculate stress, strain, and deformation for basic geometries subjected to axial loading and thermal effects.*

SIMPLE STRESSES & STRAINS : Mechanical properties of materials – Types of stresses & strains–Hooke‟s law – stress – strain diagram for mild steel – Working stress – Factor of safety- Margin of safety – Lateral strain, Poisson‟s ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr‟s circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

Learning Outcome: *After studying this unit student will know the basic terms like stress, strain poisson's ratio…etc and stresses in bars of varying cross sections, composite bars, thermal stress in members, stresses on inclined planes with analytical approach and graphical approach, strain energy under different loadings and also problem solving techniques.*

UNIT – II

Learning Objective: *To calculate bending and shear stresses from shear force and bending moment diagram for cantilever, simply supported and over hanging beams of transverse loading.*

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

Learning Outcome: *After studying this unit student will know the construction of shear force diagrams and bending moment diagrams to the different loads for the different support arrangements and also problem solving techniques.*

UNIT – III

Learning Objective: *To Calculate shear stresses for torsion loading and identify the location of shear centers for the various sections of beams.*

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

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

Learning Outcome: *After studying this unit student will know the bending and shear stress induced in the beams which are made with different cross sections like rectangular, circular, triangular, I, T angle sections and also problem solving techniques.*

UNIT – IV

Learning Objective: *To analyze the deflections in various beams subjected to various loading conditions.*

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

Learning Outcome: *After studying this unit student will know how to finding slope and deflection for different support arrangements by Double integration method, Macaulay's method and Moment-Area and also problem solving techniques.*

UNIT – V

Learning Objective: *Analyze and calculate bi-axial stresses in thick and thin cylinders, also the spherical shells.*

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

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

Learning Outcome: *After studying this unit student will know how a cylinder fails, what kind of stresses induced in cylinders subjected to internal, external pressures and also problem solving techniques.*

UNIT –VI

Learning Objective: *Analyze and calculate the stresses in shafts and failure loads of column with various boundary conditions*

TORSION: Introduction-Derivation- Torsion of Circular shafts- Stresses and strains in pure Shear- Transmission of power by circular shafts, Shafts in series, Shafts in parallel- Strain energy in torsion.

COLUMNS: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler‟s Formula, Rankine‟s Formula.

Learning Outcome: *After studying this unit student will know shear stresses induced in circular shafts, discussing columns in stability point of view and columns with different end conditions.*

TEXT BOOKS:

1. Strength Of Materials – S. Ramamrutham/ Dhanpat Rai Publications
2. Solid Mechanics, by E.P.Popov/Prentice Hall Publications
3. Strength Of Materials – R.K. Rajput/S.Chand
4. Mechanics of Materials by - Ferdinand P Beer, E Russell Johnston, and John T Dewolf.

REFERENCES:

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol-III, by S.B.Junnarkar.
4. Strength of Materials by S.Timshenko.
5. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman.
6. http://nptel.ac.in/courses/112107147/1
7. http://nptel.ac.in/courses/112107147/7
8. http://nptel.ac.in/courses/112107147/23
9. http://nptel.ac.in/courses/105106116/
10. https://en.wikipedia.org/wiki/Strength_of_materials

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year I semester -16ME3T06

L	T	P	C
4	0	0	3

THERMODYNAMICS

Course Objective:

The objective of this course is to introduce the basic principles of thermodynamics via real-world engineering examples, to show students how thermodynamics is applied in engineering practice.

Course Outcome:

This course builds the foundation for preparing students to work in the area of thermal systems.

UNIT – I

Learning Objective: *The student should be able to understand the basic concepts like thermodynamic system, its boundary and related fundamental definitions. Point function and path function shall be made with respect to energy, work, heat and temperature measurement.*

Introduction: Basic Concepts : System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle –Quasi – static Process, Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature.

Learning Outcome: *To be able to state various basic concepts of thermodynamics, and to define heat, work and difference between various forms of energy and thermometry.*

UNIT II

Learning Objective: *To learn the first law of thermodynamics, this is also the energy conservation principle, and should be able to apply to different thermodynamic systems. To learn the applications of steady flow energy equation to the various mechanical components.*

Joule‟s Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system– Steady Flow Energy Equation. Throttling and free expansion processes – deviations from perfect gas model – Vander Waals equation of state – compressibility charts – PMM I, Limitations of first law.

Learning Outcome: *To be able to apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components.*

UNIT – III

Learning Objective: *To understand the second law statements and the associated terms and should be able to apply the principles to heat engines. Should be able to analyse the concepts of Carnot cycle, entropy and irreversibility. Should be able to understand the use of Maxwells relations and thermodynamic functions.*

Thermal Reservoir, Heat Engine, Refrigeration and Heat pump, Parameters of performance,

Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence /

Corollaries, PMM of Second kind, Carnot‟s principle, Carnot cycle and its specialties,

Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy

Increase

– Energy Equation, reversibility and Irreversibility, Causes of irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

Learning Outcome: *To be able to identify the major difference in working of a heat engine, refrigerator and heat pump, To apply ideal cycle analysis to simple heat engine cycles to estimate thermal efficiency and work as a function of pressures and temperatures at various points in the cycle.*

UNIT IV

Learning Objective: *Should understand the process of steam formation and its representation on property diagrams with various phase changes and should be able to calculate the quality of steam after its expansion in a steam turbine, with the help of standard steam tables and charts.*
Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Learning Outcome: *To be able to Familiarity with the construction and principles governing the form of simple and complex one-component pressure-temperature diagrams and the use of volume-temperature and pressure-volume phase diagrams and the steam tables in the analysis of engineering devices and systems.*

UNIT – V

Learning Objective: *Should be able to know various fuels and combustion, Analyze the mixtures of perfect gases.*

Types of fuels - Exothermic and endothermic reactions - Combustion equations – Stoichiometry, Mixtures of perfect Gases – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton‟s Law of partial pressure, Avogadro‟s Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour.

Learning Outcome: *Ability to determine the fuels and combustion, equilibrium states of a wide range of systems, ranging from mixtures of gases, mixtures of gases and pure condensed phases, and mixtures of gases, liquids, and solids that can each include multiple components.*

UNIT - VI

Learning Objective: *To understand the concept of air standard cycles and should be able to calculate the efficiency and performance parameters of the systems that use these cycles.*

Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Brayton Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

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

Learning Outcome: *Ability to determine analysis of various air standard cycles.*

TEXT BOOKS :

1. Engineering Thermodynamics , PK Nag, TMH.
2. Thermodynamics– Y.A.Cengel & M.A.Boles , 7th Edn - McGrawHill

REFERENCES:

1. Thermodynamics – J.P.Holman , McGrawHill
2. Basic Engineering Thermodynamics – A.Venkatesh – Universities press.
3. An Introduction to Thermodynamics - Y.V.C.Rao – Universities press.
4. Thermodynamics – W.Z.Black & J.G.Hartley, 3rd Edn Pearson Publ.
5. Engineering Thermodynamics – R K Rajput, Laxmi publications Ltd..
6. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ.
7. Fundamentals of Classical Thermodynamics - G.J.VanWylen& Sonntag.
8. http://nptel.ac.in/courses/112105123/1
9. http://nptel.ac.in/courses/Webcourse contents/IITKANPUR/Basic_Thermodynamics/ui/TOC.html
10. http://www.nptelvideos.in/2012/12/basic-thermodynamics.html

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year I semester -16ME3T07

L	T	P	C
4	0	0	3

FLUID MECHANICS & HYDRAULIC MACHINES

Course Objective:

The students completing this course are expected to understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. Further, the student shall be able to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

Course Outcome:

This course provides fundamental knowledge and understanding of the mechanics of fluid at rest and in motion by describing and observing fluid phenomena and by developing and using the principles and laws for analyzing fluid interactions with natural and constructed systems. This course provides the basis for subsequent courses involving the analysis, design and/or operation of engineered systems: water and waste water treatment facilities; flooding, erosion and wave impacts on river, lake and coastal areas; transport and mixing of chemicals and sediments; and earth and solid structures for containing fluids.

UNIT I

Learning Objective: *To provide knowledge on different fluid properties, Manometry and to estimate the Hydro static forces on submerged bodies.*

FLUID STATICS: Dimensions and units: physical properties of fluids-specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric gauge and vacuum pressure – measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal‟s law, hydrostatic law.

BUOYANCY AND FLOATATION: Meta center, stability of floating body. Submerged bodies. Calculation of meta center height. Stability analysis and applications.

Learning Outcome: *Able to understand the concepts of fluid properties, able to determine the pressure head of a fluid in a pipe by using manometer and able to analyze hydrodynamic forces in submerged bodies and realize the concepts of buoyant force, centre of buoyancy.*

UNIT II

Learning **Objective:** *To learn about the different types of fluid flows, flow patterns and forces behind the flow and to study the energy equation and Momentum equation and also to find the losses occurs in flow through the pipes, their corresponding problems.*

FLUID KINEMATICS: Introduction, flow types. Equation of continuity for one dimensional flow. Circulation and vorticity. Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

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

CLOSED 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.

Learning Outcome: *Able to develop basic understanding of the fundamental equations of fluid mechanics and apply the Bernoulli's equation to solve problems in fluid flows, understand the minor losses and evaluate the performance of a fluid transport system.*

UNIT III

Learning Objective: *To provide knowledge about different concepts of boundary layer theory, flow separation, basic concepts of velocity profiles, dimensionless numbers and dimensional analysis.*

BOUNDARY LAYER THEORY: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.
DIMENSIONAL ANALYSIS: Similitude and modeling – Dimensionless numbers
***Learning Outcome*:** *Able to understand about laminar and turbulent boundary layer concepts.*
UNIT IV
Learning Objective: *To learn about the hydrodynamic forces acting on vanes and their performance evaluation.*

BASICS OF 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 and efficiency, flow over radial vanes.

Learning Outcome: *Able to analyze hydro dynamic forces on different vanes with various jet striking points.*

UNIT V

Learning Objective: *To study types of centrifugal Pumps, work done and efficiency and also study about performance of pumps & characteristic curves and also about reciprocating pumps.*

CENTRIFUGAL PUMPS: Classification, working, work done – manometric head-losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.
RECIPROCATING PUMPS: Working, Discharge, slip, indicator diagrams.

Learning Outcome: *Able to analyze different types of working pumps and also used for the estimation of efficiency of different pumps and performance of the pumps with the study of characteristics curves.*

UNIT VI

Learning Objective: *To study different turbines, draft tube theory and to determine the function efficiency and governing, performance characteristics of different types of turbines.*

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: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems-hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

Learning Outcome: *Able to the select the type of turbine required with reference to available head of water and also used for Identification of type of turbine with estimated specific speed.*

TEXT BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley, John Wiley & Sons Inc. 2004 (Chapter 12 – Fluid Flow Measurements)
5. Fluid Mechanics and Hydraulic Machines by Domkundwar & Domkundwar, D
6. http://nptel.iitm.ac.in/courses
7. http://nptel.iitm.ac.in/courses/105101082/ ;
8. http://nptel.iitm.ac.in/courses/105101082/;
9. http://www.youtube.com/watch?v=FENCiAEfaA&feature=player_detailpae
10. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv078Page1.htm
11. http://www.learnerstv.com/video/Free-video-Lecture-2630-Engineering.htm
12. http://www.learnerstv.com/video/Free-video-Lecture-2654-Engineering.htm
13. http://ga.water.usgs.gov/edu/hyhowworks.html
14. http://www.youtube.com/watch?v=wvxUZF4lvGw&feature=player_detailpe
15. http://www.mech.uq.edu.au/courses/mech7350/lecture-notes-in-pdf/mech7350-10-hydraulic-turbines.pdf

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

II year I semester -16ME3T08

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COMPUTER AIDED ENGINEERING DRAWING PRACTICE

Course Objective*:*

To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.

Course Outcome:

Upon completion of this course, students should able to Understand advanced engineering drawing as per the latest BIS standards, to produce engineering design drawings using a Computer Aided Design (CAD) system, be able to read and interpret drawings, be able to draw & dimension 2D diagrams in standard 2D blueprint form, to demonstrate the ability to draft a component using different CAD packages.

PART A

Unit-I:

Learning Objective: *The knowledge of projections of solids is essential in 3D modeling and animation. The student will be able to draw projections of solids. The objective is to enhance the skills they already acquired in their earlier course in drawing of projection and sections of solids.*

PROJECTIONS OF SOLIDS: Projections of Regular Solids inclined to both the planes. Auxiliary Views, Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone.

Learning Outcomes: *On Successful completion of this unit the students will be able to draw the projections of the various types of solids in different positions inclined to both the planes*

Unit-II:

Learning Objective: *The knowledge of development of surfaces of solids is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection. The intersection of solids also plays an important role in designing and manufacturing. The objective is to impart this knowledge through this topic.*

DEVELOPMENT OF SURFACES: Development of lateral surfaces of vertical prism, cylinder, pyramid, and cone truncated by surfaces of inclined to HP alone. Development of surfaces of vertical cylinder and prism with cylindrical cut outs perpendicular to the axis.

Interpenetration of Right Regular Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

Learning Outcomes: *On Successful completion of this unit the students will be able to draw the developments of surfaces and various types of solids.*

UNIT-III

Learning Objective: *Isometric projections provide a pictorial view with a real appearance. Perspective views provides a realistic 3D View of an object. The objective is to make the students learn the methods of Iso and Perspective views.*

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. Transformation of Projections: Conversion of Isometric Views to Orthographic Views – Conventions.

PERSPECTIVE PROJECTIONS: Perspective View: Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods (General Method only).

Learning Outcomes: *On Successful completion of this lab the students will be able to draw the isometric view and Perspective View of a given three dimensional object/part.*

PART B

COMPUTER AIDED DRAFTING IS INTRODUCED:

Unit IV:

Learning Objective: *The objective is to introduce various commands in AutoCAD to draw the geometric entities and to create 2D and 3D wire frame models.*

Introduction to Computer aided Drafting: Generation of points, lines, curves, polygons, dimensioning. Types of modeling: object selection commands – edit, zoom, hatching, pattern filling, utility commands, 2D wire frame modeling, 3D wire frame modeling.

Learning Outcomes: *After completion of this unit students are able to understand the Auto-CAD draw commands and edit commands.*

Unit V:

Learning Objective: *By going through this topic the student will be able to understand the paper-space environment thoroughly.*

View points and view ports: view point coordinates and view (s) displayed, examples to exercise different options like save restore, delete, joint, single option.

Learning Outcomes: *After completion of this unit students are able to understand the save restore, delete, joint, single option commands in Auto-CAD.*

Unit VI:

Learning Objective: T*o make the students create geometrical model of simple solids and machine parts and display the same as an Isometric, Orthographic or Perspective projection.*

Computer aided Solid Modeling: Isometric projections, orthographic projections of isometric projections, modeling of simple solids, Modeling of Machines & Machine Parts.

Learning Outcomes: *After completion of this unit students are able to understand: Draw 2-D drawings of conventional engineering objects using Auto-CAD.*

TEXT BOOKS:

1.Engineering Graphics, K.C. john, PHI Publications
2.Engineering drawing by N.D Bhatt , Charotar publications.

REFERENCES:

1.Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura, Sybex.
2.Auto CAD 2013 fundamentals- Elisemoss, SDC Publ.
3.Engineering Drawing and Graphics using Auto Cad – T Jeyapoovan, vikas.
4.Engineering Drawing + Auto CAD – K Venugopal, V. Prabhu Raja, New Age.
5.Engineering Drawing – RK Dhawan, S Chand
6.Engineering Drawing – MB Shaw, BC Rana, Pearson
7.Engineering Drawing – KL Narayana, P Kannaiah, Scitech
8.Engineering Drawing – Agarwal and Agarwal, Mc Graw Hill
9.Engineering Graphics – PI Varghese, Mc Graw Hill.
10. Text book of Engineering Drawing with auto-CAD, K.venkata reddy / B.S. publications.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year I semester -16BH3T14

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MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Unit – I

(*The Learning objective of this Unit is to understand the concept and nature of Managerial Economic s and its relationship with other disciplines, Concept of Demand and Demand forecasting)

Introduction to Managerial Economics and demand Analysis:
Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Basic Economic Tools used in Managerial Economics-Concepts of Demand-Types-Determents-Law of Demand its Exception-Elasticity of Demand-Types andMeasurement- Law of Supply -Demand forecasting and it‟s Methods.
*(**The Learner is equipped with the knowledge of estimating the Demand for a product and the relationship between Price and Demand)*

Unit – II

(*The Learning objective of this Unit is to understand the concept of Production function,Input Output relationship, different Cost Concepts and Concept of Cost-Volume-Profit Analysis)

Production and Cost Analyses:
Production function-Isoquants and Isocosts-Law of Variable proportions- Laws of Returns to Scale-Cobb-Douglas Production function-Economies of Scale-Cost Concepts- Fixed vs Variable Costs-Out of Pocket Costs vs Imputed Costs-Cost Volume Profit analysis-Determination of Break-Even Point (Simple Problems)

*(**One should understand the Cost Concepts for decision making and to estimate the least cost combinationof inputs).*

Unit – III
(*The Learning Objective of this Unit is t understand the Nature of Competition,Characteristics of Pricing in the different market structure and significance of various pricing methods)

Introduction to Markets, Theories of the Firm & Pricing Policies:
Market Structures: Perfect Competition, Monopoly and Monopolistic and Oligopoly – Features – Price,Output Determination – Managerial Theories of firm: Marris and Williamson‟s models – Methods of Pricing:Limit Pricing, Market Skimming Pricing, Internet Pricing: Flat Rate Pricing, Usage sensitive, Transactionbased pricing, Priority Pricing.

*(** One has to understand the nature of different markets and Price Output determination under variousmarket conditions)*

Unit – IV

(*The Learning objective of this Unit is to know the different forms of Businessorganization and their Merits and Demerits both public & private Enterprises and the concepts ofBusiness Cycles)

Types of Business Organization and Business Cycles:

Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises andtheir forms
– Business Cycles – Meaning and Features – Phases of Business Cycle.

*(**One should be equipped with the knowledge of different Business Units)*

Unit – V

(*The Learning objective of this Unit is to understand the different Accounting Systemspreparation of Financial Statements)

Introduction to Accounting:

Introduction to Double Entry Systems-Journal-Ledger- Trail Balance - Preparation of Financial Statements - Analysis and Interpretation of Financial Statements-Ratio Analysis – liquidity ratios, profitability ratios, solvency ratios, turnover ratios

– Preparation of the Funds flow Statement (Simple Problems)

*(**The Learner is able to prepare Financial Statements)*

Unit – VI

*(*The Learning objective of this Unit is to understand the concept of Capital, Capitalization, Capital Budgeting and to know the techniques used to evaluate Capital Budgeting proposals by using different methods* ***and uses of different***
tools for performance evaluation

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Sources of Finance (with special reference to Shares and Debentures)-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.

*(**The Learner is able to understand the usage of various Ratios for financial Analysis and evaluates various investment project proposals with the help of capital budgeting techniques for decision making)*

Note: *Learning Objective

** Learning Assessment

TEXT BOOKS

1.Dr. N. Appa Rao, Dr. P. Vijay Kumar: „Managerial Economics and Financial Analysis", Cengage
Publications, New Delhi – 2011
2.Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3.Prof. J.V.Prabhakararao, Prof. P. Venkatarao. „Managerial Economics and Financial Analysis", RavindraPublication.

REFERENCES:

1.V. Maheswari: Managerial Economics, Sultan Chand.
2.Suma Damodaran: Managerial Economics, Oxford 2011.
3.Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.
4.Vanitha Agarwal: Managerial Economics, Pearson Publications 2011.

5.Sanjay Dhameja: Financial Accounting for Managers, Pearson.
6.Maheswari: Financial Accounting, Vikas Publications.
7.S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age InternationalPublishers, 2012

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year I semester -16ME3L02

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METALLURGY & MECHANICS OF SOLIDS LAB

METALLURGY:

Course Objective: *To impart practical exposure on the microstructures of various materials and their hardness evaluation.*

Course outcome: *The ability to learn about the various types, properties and applications of materials along with their structures.*

LIST OF EXPERIMENTS:

1. Preparation and study of the Microstructure of Al
2. Preparation and study of the Microstructure of Cu.
3. Preparation and Study of the Microstructure of Gray Cast-iron.
4. Preparation and Study of the Microstructure of Stainless steel
5. Preparation and Study of the Microstructure of Brass
6. Preparation and Study of the Microstructure Malleable Cast Iron

Note*: Any 5 experiments are to be conducted among 6*

MECHANICS OF SOLIDS:

Course Objectives: *To study the stress –strain variation in mild steel and to determine its young's modulus, to compare the analytical and experimental values of the stress and deflection in the cantilever beam, to compare the analytical and experimental values of the stress and deflection in the simply supported beam.*

Course Outcomes: *At the end of course student will be able to estimate compressive strength of wood/Concrete/Brick materials, check the suitability of wood, steel and concrete in construction works, find the impact resistance of steel used in construction works.*

LIST OF EXPERIMENTS:

1. Estimate young‟s modulus of wood/steel materialsDirect Tension test on Universal Testing Machine (UTM)
2. Bending test on simply supported beam steel.
3. Bending test on simply supported beam Wood.
4. Bending test on cantilever beam Steel
5. Torsion test
6. Brinell‟s hardness test
7. Rockwell hardness test
8. Test on Tension springs.
9. Test on Compression springs
10. Compression Test on wood.
11. Charpy Impact test.
12. Izod Impact test.

Note: *Any 5 experiments are to be conducted among 12*

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year I semester -16EE3L03

L	T	P	C
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ELECTRICAL & ELECTRONICS ENGINEERING LAB

To plot characteristics of semiconductor devices and machines. To Study the operation of CRO and Three Point Starter.

ANY FIVE EXPERIMENTS ARE TO BE CONDUCTED FROM EACH PART

PART – A

1. CRO and its usage in various measurements.
2. Diode Characteristics and rectifier application.
3. BJT Characteristics.
4. SCR Characteristics and rectifier application.
5. Frequency Response of CE Amplifier.
6. Frequency Response of CC Amplifier.

PART – B

1. Study of Three Point Starter.
2. Magnetization Characteristics of DC Shunt Generator.
3. Swinburne‟s Test on DC Shunt Machine.
4. Brake Test on DC Shunt Motor.
5. OC and SC test on Single Phase Transformer.
6. Brake Test on Three Phase Induction Motor.

Learning Outcome:

Able to plot characteristics of semiconductor devices and machines. Able to know the operation of CRO and Three Point Starter.

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II year II semester -16ME4T10

L	T	P	C
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KINEMATICS OF MACHINERY

Course Objective:

The students completing this course are expected to understand the nature and role of the kinematics of machinery, the mechanisms and machines. The course includes velocity and acceleration diagrams, analysis of mechanisms, joints, Cams and their applications. It exposes the students to various kinds of power transmission devices like belt, rope , chain and gear drives and their working principles and their merits and demerits.

Course Outcome*:*

The Student will be familiar with common mechanisms used in machines and everyday life and ability to calculate mobility and enumerate rigid links and types of joints within mechanisms. He will able to choose a mechanism to generate the exact and approximate straight line mechanisms. Understand various steering mechanisms and the importance of universal (Hooke's) joint. Able to analyze various planar mechanism for displacement, velocity and acceleration graphically, and have an idea about synthesis of a simple planar mechanism. He understand various cam motion profiles and follower mechanism, their classification and design based on the prescribed follower motion (SHM, constant velocity and acceleration). Student able to understand gear mechanism, classification and to become familiar with gear standardization and specification in design. He also understands importance of gear trains and their practical applications. The student able to understand uses and advantages of various power transmission drives and their selection depending upon the application.

UNIT – I

Learning Objective**:** *The objective of this unit is to make student understand the purpose of kinematics, Kinematic joint and mechanism and to study the relative motion of parts in a machine without taking into consideration the forces involved.*

MECHANISMS : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained, Grubler's criterion, Grashoff's law , Degrees of freedom, Kutzbach criterian for planar mechanisms, Mechanism and machines – classification of machines – kinematic chain –inversion of mechanism-inversions of quadric cycle, chain – single and double slider crank chains. Kinematic synthesis of four bar mechanism with simple problems.

Learning Outcome**:** *Understand the purpose of kinematics, mechanisms and inversions*

UNIT – II

***Learning Objective*:** *The objective of this unit is to make student understand various mechanisms for straight line motion and their applications including steering mechanism.*

LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russul – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph. Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio; Hooke‟s Joint: Single and double – Universal coupling– application–problems.

***Learning Outcome*:** *Analyze design related problems of straight line motion mechanisms effectively and get knowledge on steering mechanisms*

UNIT – III

***Learning Objective*:** *The objective of this unit is to make student understand the velocity and acceleration concepts and the methodology using graphical methods and principles and application of four bar chain.*

KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Velocity and acceleration analysis of for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.

PLANE MOTION OF BODY: Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

***Learning Outcome*:** *Understand the velocity and acceleration concepts of four bar chain, determination of instantaneous centre and finding out the angular velocity of points and links*

UNIT – IV

***Learning Objective*:** *The objective of this unit is to make student understand the theories involved in cams. Further the students are exposed to the applications of cams and their working principles.*

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases. Analysis of motion of followers: Roller follower – circular cam with straight, concave and convex flanks.

***Learning Outcome*:** *Get the knowledge on types of cams and followers, drawing cam profile and the theories involved*

UNIT – V

***Learning Objective*:** *The objective of this unit is to make student understand gears, power transmission through different types of gears including gear profiles and its efficiency.*

GEARS: Higher pairs, friction wheels and toothed gears–types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – Introduction to Helical, Bevel and worm gearing.

***Learning Outcome*:** *Know the different types of gears and understand the important principles like law of gearing and interference phenomena*

UNIT – VI

***Learning Objective*:** *The objective of this unit is to make student understand various power transmission mechanisms and methodologies and working principles. Students are exposed to merits and demerits of each drive.*

POWER TRANSMISSIONS: Introduction, Belt and rope drives, selection of belt drive-types of belt drives,V-belts, materials used for belt and rope 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, Chains- length, angular speed ratio, classification of chains.Introduction to gear Trains, Train value, Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains.Selection of gear box-Differential gear for an automobile.

***Learning Outcome*:** *Have Knowledge on various kinds of power transmission devices like belts, ropes chain drives, their limitations, applications and selection of drives and calculation of power transmitted.*

TEXT BOOKS:

1. Mechanism and Machine Theory by Ashok G. Ambekar, PHI Publishers.
2. Theory of Machines – S. S Rattan- TMH.
3. Theory of machines and Mechanisms – J.J Uicker, G.R.Pennock & J.E. Shigley - Oxford publishers.

REFERENCES:

1. Theory of Machines Sadhu Singh Pearsons Edn
2. Theory of machines and Machinery /Vickers /Oxford .
3. Theory of Machines by Thomas Bevan/ CBS
4. Kinematics of Machinery through Hyper Works – J.S. Rao – Springer Publ.
5. Theory of Mechanisms and machines – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd.
6. http://nptel.ac.in/courses/112104121/1

http://nptel.ac.in/courses/112103174/17

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year II semester -16ME4T11

L	T	P	C
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THERMAL ENGINEERING – I

Course Objectives:

To make the student learn and understand Engine systems and its performance by testing, working of various parts of the Engines.

Course Outcomes:

The students learn and understand about the Engine systems and its performance by testing, working of various parts of the Engines.

UNIT – I

Learning Objective: *To make the student learn and understand the reasons and affects of various losses that occurs in the actual engine operation.*

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

Learning Outcome: *The student learn about the reasons and affects of various losses that occur in the actual engine operation.*

UNIT – II

Learning Objective**:** *To familiarize the student with the various engine systems along with their function and necessity.*

I. C. ENGINES : Classification - Working principles, Valve and Port Timing Diagrams, Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of wankle engine, principles of supercharging and turbo charging, DTSI technology.

Learning Outcome**:** *The student learn about various engine systems along with their function and necessity.*

UNIT – III

Learning Objective**:** *To learn about normal combustion phenomenon and knocking in S.I. and C.I. Engines and to find the several engine operating parameters that affect the smooth engine operation.*

Combustion in S.I. Engines : Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

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

Learning Outcome**:** *The student learn about the normal combustion phenomenon and knocking in S.I. and C.I. Engines and to find the several engine operating parameters that affect the smooth engine operation.*

UNIT – IV

Learning Objective**:** *To make the student learn to perform testing on S.I and C.I Engines for the calculations of performance and emission parameters.*

Measurement, Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

Learning **Outcomes:** *The student learn to perform testing on S.I and C.I Engines for the calculations of performance and emission parameters.*

UNIT – V

Learning Objective**:** *To make students learn about different types of compressors and to calculate power and efficiency of reciprocating compressors.*

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

Reciprocating: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, under cooling, saving of work, minimum work condition for stage compression.

Learning Outcome**:** *The students learn about different types of compressors and to calculate power and efficiency of reciprocating compressors.*

UNIT VI

Learning Objective**:** *To make students learn mechanical details, and to calculate power and efficiency of rotary compressors*

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

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

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

Learning Outcome**:** *The student learn about the mechanical details, and to calculate power and efficiency of rotary compressors*

TEXT BOOKS:

1.I.C. Engines / V. GANESAN- TMH

2.Heat engines, vasandani & Kumar publications Thermal

REFERENCES:

1.IC Engines – M.L. Mathur & R.P. Sharma – Dhanpath Rai & Sons.

2.I.C. Engines – Applied Thermosciences – C.R. Ferguson & A.T. Kirkpatrick-2nd Edition-Wiley Publ.

3.I.C. Engines - J.B. Heywood /Mc Graw HIll.

4.Thermal Engineering – R.S.Khurmi & J.S.Gupta- S.Chand Publ.

5.http://nptel.ac.in/courses/112105123/

6.http://nptel.ac.in/courses/112108148/

7.http://nptel.ac.in/courses/112104113/

8.http://nptel.ac.in/courses/112104033/

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year II semester -16ME4T12

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PRODUCTION TECHNOLOGY

Course Objective:

To impart basic knowledge and understanding about the primary manufacturing processes such as casting, joining, forming and powder metallurgy and their relevance in current manufacturing industry; To introduce processing methods of plastics.

***Course Outcome*:**

On completion of this course, the student understands all the production technologies for medium and large scales manufacture. The student will confidently in a position to set up and operate production set-up dealing with welding, casting, rolling, sheet metal operations and plastic molding and extrusion processes. The student also will aim at production at high quality and low costs which will optimize the resources in production.

UNIT – I

***Learning Objective*:** *To make the students understand fundamentals of casting.*

CASTING : Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems

***Learning Outcome*:** *After completing this chapter student will be able to understand the history of metal casting processes, Design patterns and various moulding materials, Design of Gating systems for different castings.*

UNIT – II

***Learning Objective*:** *To provide insight into sand casting and introduce other casting processes*

Methods of melting and types of furnaces, Solidification of castings, Solidification of pure metals and alloys, short & long freezing range alloys. Risers – Types, function and design, casting design considerations, Basic principles and applications of Centrifugal casting, Die casting and Investment casting

***Learning Outcome*:** *After completing this chapter student will be able to understand the functioning of cupola furnaces for melting cast iron, Design castings to ensure simple moulding with less number of defects, use of permanent mould casting for mass production of relatively simple shapes.*

UNIT – III

***Learning Objective*:** *To impart fundamentals of gas welding and arc welding.*

Welding : Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting.

Basic principles of Arc welding, Manual metal arc welding, Sub merged arc welding, Inert Gas welding- TIG & MIG welding.

Learning Outcome**:** *After completing this chapter student will be able to understand the utilize gas welding processes for low volume and repair work, select different arc welding processes for large volume manufacture.*

UNIT – IV

Learning Objective: *To teach principles of advanced welding processes and their applications.*

Resistance welding, Solid state welding processes- Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma welding, Laser welding, electron beam welding, Soldering & Brazing.

Heat affected zones in welding; pre & post heating, Weldability of metals, welding defects – causes and remedies – destructive and nondestructive testing of welds, Design of welded joints.

Learning Outcome**:** *After completing this chapter student will be able to understand the use resistance welding processes for sheet metals joints, different types of welding processes used for special fabrication applications, learn brazing and soldering applications.*

UNIT – V

Learning Objective: *To impart knowledge on bulk forming processes*.

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

Introduction to powder metallurgy – compaction and sintering, advantages and applications

Learning Outcome: *After completing this chapter student will be able to understand the advantages of utilizing the metal-working processes, learn about different rolling, forging, extrusion processes and applications.*

UNIT – VI

Learning Objective: *To provide understanding the basics of powder metallurgy and processing of plastics.*

Sheet metal forming - Blanking and piercing, Forces and power requirement in these operations,Deep drawing, Stretch forming, Bending, Springback and its remedies, Coining, Spinning, Types of presses and press tools.

Processing of Plastics: Types of Plastics, Properties, Applications and their processing methods, Blow and Injection molding.

Learning Outcome**:** *After completing this chapter student will be able to understand the basics of powder metallurgy, various metal-powder production methods, different steps involved in powder metallurgy part preparation. Lean about different plastic materials and their properties for engineering applications and blow and injection moulding process and other variant of the same.*

TEXT BOOKS:

1. Manufacturing Processes for Engineering Materials - Kalpakjian S and Steven R Schmid- Pearson Publ , 5th Edn.
2. Fundamentals of Modern Manufacturing - Mikell P Groover- Wiley publicaitons – 3rd Edition.
3. Introduction to basic manufacturing processes and workshop technology-Rajender Singh- New Age International Publishers.
4. Production Technology- R.K. Jain- Khanna

REFERENCES:

1. Manufacturing Science – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd.
2. Process and materials of manufacture- Lindberg- PHI
3. Manufacturing Technology -Vol I- P.N. Rao- TMH
4. Production Technology-P C Sharma-S. Chand
5. Manufacturing Processes- H.S. Shaun- Pearson
6. Manufacturing Processes- J.P. Kaushish- PHI
7. http://nptel.ac.in/courses/112107145/4
8. http://nptel.ac.in/courses/112107145/5
9. http://nptel.ac.in/courses/112107145/7
10. http://nptel.ac.in/courses/112107145/23#

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

II year II semester -16ME4T13

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DESIGN OF MACHINE MEMBERS – I

Course Objectives:

The student shall gain appreciation and understanding of the design function in mechanical engineering, the steps involved in designing and the relation of design activity with manufacturing activity selection of proper materials to different machine elements based on their physical and mechanical properties. Learn and understanding of the different types of failure modes and criteria. Procedure for the different machine elements such as fasteners, shafts, couplings, keys, axially loaded joints etc.

Course Outcomes:

Upon successful completion of this course student should be able to apply the design procedure to engineering problems, including the consideration of technical and manufacturing constraints. Select suitable materials and significance of tolerances and fits in critical design applications. Utilize design data hand book and design the elements for strength, stiffness and fatigue. Identify the loads, the machine members subjected and calculate static and dynamic stresses to ensure safe design.

UNIT – I

Learning Objective: *To analyze the basic design concepts and standards of any mechanical component. Also the student can understand the design procedure and selection of material for a specific application. Apply failure theories in evaluating strength of machine elements.*

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

STRESSES IN MACHINE MEMBERS: Simple stresses – combined stresses – Torsional and bending stresses – impact stresses- Various theories of failure under static load – factor of safety – design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations – static strength design based on fracture toughness.

Learning Outcome: *Understand the design procedure and selection of material for a specific application and standards.*

UNIT – II

Learning Objective: *To analyze machine components subjected to static and variable loads.*

STRENGTH OF MACHINE ELEMENTS: Stress concentration – theoretical stress concentration factor – fatigue stress concentration factor notch sensitivity – design for fluctuating stresses – Endurance limit – Estimation of endurance strength –Factor of safety for fatigue loading- Goodman‟s line – Soderberg‟s line – Modified Goodman‟s line.

Learning Outcome: *Design a component when it is subjected to variable loads.*

UNIT – III

Learning Objective: *To introduce the basic principles for design of machine elements such as riveted joints, welded joints, bolted joints and Bolted joints.*

Types of riveted heads and riveted joints- Lap Joint – Butt joint- Riveted joints–Design of joints with initial stresses – Welded joints- Strength of parallel fillet and Transverse fillet welded joints- Eccentric loading. Bolted joints – design of bolts with pre-stresses – design of joints under eccentric loading – locking devices – both of uniform strength, different seals. Caulking and Fullering.

Learning Outcome: *Analyze and design permanent joints such as the riveted and welded joints under various loading conditions.*

UNIT – IV

Learning Objective: *To understand various joints subjected to axial loading and design of shafts*.

KEYS, COTTERS AND KNUCKLE JOINTS: Classification of Keys-Design of keys-stresses in keys-cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints-knuckle joints.
SHAFTS: Design of solid and hollow shafts for strength and rigidity – design of shafts for combined bending and axial loads – shaft sizes – BIS code. Use of internal and external circlips, gaskets and seals (stationary & rotary).

Learning Outcome: *Analyze and design joints such as keys and cotter joint and knuckle joints under various loading conditions. Analyze and design both hollow and solid shafts.*

UNIT – V

Learning Objective: *To understand various shaft couplings subjected to torsion*.

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

Learning Outcome: *Design shaft couplings for various engineering applications*

UNIT – VI

Learning Objective: *To understand the behavior and design of springs at various loading conditions*

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

Learning Outcome: *Analyze the deformations of various springs at different loading conditions*

TEXT BOOKS:

1.Design of Machine Elements by V.Bandari, TMH Publishers
2.A Text Book of Machine Design by R.S Khurmi & J.K Gupta

3.Machine design – Pandya & Shah

REFERENCES:

1.Design of Machine Elements / V.M. Faires

2.Machine design / Schaum Series.

3.Data books (1) PSG College of technology (2) Mahadevan

4.http://nptel.ac.in/courses/112105124/5
5.http://nptel.ac.in/courses/112105124/7
6.http://nptel.ac.in/courses/112105124/13
7.http://nptel.ac.in/courses/112105124/20
8.http://nptel.ac.in/courses/112105124/35

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year II semester -16ME4T14

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MACHINE DRAWING

Course Objective:

The student will acquire knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

Course Outcome:

Upon the completion of the course the students are able to analyze and draw the machine component as per given standard, to know how to assemble the various machine components.

Machine Drawing Conventions:

Learning Objective: *To provide basic understanding of Conventional representation, sections, dimensioning, drawing sheet sizes and types of drawings.*

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs, Symbols for weldments.
b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
c)Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
d) Title boxes, their size, location and details - common abbreviations & their liberal usage.
e) Types of Drawings – working drawings for machine parts.

Learning Outcome**:** *On Successful completion of this above section the students will be able to represent different kinds of materials and Mechanical components conventionally.*

I. Drawing of Machine Elements and simple parts

Learning Objective**:** *To provide basic understanding and drawing practice of various joint, simple mechanical parts Selection of Views, additional views for the following machine elements and parts with every drawing proportion.*

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Keys, cottered joints and knuckle joint.
c) Rivetted joints for plates
d) Shaft coupling, spigot and socket pipe joint.
e) Journal, pivot and collar Pedastal Bearing (Plummer Block) and foot step bearings.

Learning Outcome**:** *On Successful completion of this above section the students will be able to understand the shape and structure of different types of screws, keys and Couplings.*

II. Assembly Drawings:

***Learning* Objective:** *The student will be able to draw the assembly from the individual part drawing.*

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) **Engine parts:**
   - Stuffing box,
   - Cross heads,
   - Eccentrics,
   - Petrol Engine connecting rod,
   - Piston assembly.

b) **Other machine parts:**
   - Screws jacks,
   - Machine Vices,
   - Single Tool post

c) **Valves :**
   - Steam stop valve,
   - Spring loaded safety valve,
   - Feed check valve and

***Learning Outcome*:** *On Successful completion of this above section the students will be able to Produce the assembly drawing using part drawings.*

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

TEXT BOOKS:

1.Machine Drawing – Dhawan, S.Chand Publications
2.Machine Drawing –K.L. Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers.
3.Machine Drawing including Auto CAD – Ajeet Singh/McGraw Hill Education.

REFERENCES:

1.Machine Drawing – N.Siddeswar, K.Kannaiah & V.V.S.Sastry - TMH
2.Machine Drawing – P.S.Gill,
3.Machine Drawing – Luzzader
4.Machine Drawing – Rajput
5.Machine Drawing – N.D. Junnarkar, Pearson
6.Machine Drawing – Ajeeth Singh, McGraw Hill
7.Machine Drawing – KC John, PHI
8.Machine Drawing – B Battacharya, Oxford
9.Machine Drawing – Gowtham and Gowtham, Pearson

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year II semester -16ME4T15

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INDUSTRIAL ENGINEERING AND MANAGEMENT

Course Objective:

To impart fundamental knowledge and skill sets required in the Industrial Management and Engineering profession, which include the ability to apply basic knowledge of mathematics, probability and statistics, and the domain knowledge of Industrial Management and Engineering.To produce graduates with the ability to adopt a system approach to design, develop, implement and innovate integrated systems that include people, materials, information, equipment and energy.To enable students to understand the interactions between engineering, business, technological and environmental spheres in the modern society.To enable students to understand their role as engineers and their impact to society at the national and global context.

Course Outcome:

Upon successful completion of this course you should be able to analyze the plant location sites and preferable layouts based on the availabilities, to maintain good leadership and considerations of labor welfare, to types of work studies and processing charts, job evaluating techniques, to enterprise planning and project management.

UNIT – I

Learning Objective*: *To make students learn about management, organization principles and also motivational qualities and leadership qualities.

MANAGEMENT AND ORGANIZATION:

Definition – meaning and nature of management- Functions of management-Evolution of management thought-

Taylor‟s Scientific management- Fayol‟s Principles of management- Basic concepts related to organization-Departmentation, Delegation and Decentralization, Type of organization structures-authority, responsibility and accountability

MOTIVATION THEORIES AND LEADERSHIP:

Definition, Meaning and Types of Motivation – Theories of Motivation-Douglas Mc Gregor Theory X and Theory Y,

Mayo‟s Hawthorne Experiment- Herzberg two factor theory of motivation, Maslow‟s hierarchy of human needs

Leadership: Definition, Meaning, Features and Types of Leadership (Autocratic, Democratic and Lassie Faire)

***Learning Outcome:** Upon completion of the topics the student will learn about management, organization principles and also motivational qualities and leadership qualities*

UNIT – II

Learning Objective**:** *To make students learn about where to and how to locate a plant, difficulties of plant layouts. Maintenance of a plant (organization)*

PLANT LOCATION & LAYOUT:

Factors governing plant location, types of production layouts, comparison of rural and urban sites, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and breakdown maintenance, types of plant layout-various data analyzing forms-travel chart.

Learning Outcome**:** *Upon completion of the topics the student will learn about where to and how to locate a plant, difficulties of plant layouts. Maintenance of a plant (organization)*

UNIT – III

Learning Objective**:** *To make students learn about types of work studies and processing charts, job evaluating techniques.*

OPERATIONS MANAGEMENT: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

Learning Outcome**:** *Upon completion of the topics the student will learn about types of work studies and processing charts, job evaluating techniques.*

UNIT – IV

Learning Objective**:** *To make students learn about types of quality control charts and improvement of quality with analysis techniques*

STATISTICAL QUALITY CONTROL: Quality control, its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – $\bar{X}$ and R – charts $\bar{X}$ and S charts and their applications, numerical examples.

TOTAL QUALITY MANAGEMENT: zero defect concept, quality circles, implementation, applications, ISO quality systems. Six sigma – definition, basic concepts

Learning Outcome**:** *Upon completion of the topics the student will learn about types of quality control charts and improvement of quality with analysis techniques*

UNIT – V

Learning Objective**:** *To make students learn about industrial disputes and labor welfare*

INDUSTRIAL RELATIONS & LABOR WELFARE: Definition of Industrial dispute – causes of Industrial dispute

– (Internal & External) – machinery to solve industrial disputes, grievance management, attendance and leave, labor Act-2003, Factories Act-1948, workmen‟s Compensation Act- 1923.

RESOURCE MANAGEMENT: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, types.

Labor welfare: Meaning- Statutory and Non Statutory Act

Learning Outcome: *Upon completion of the topics the student will learn about industrial disputes and labor welfare*

UNIT – VI

Learning Objective**:** *To make students learn about enterprise planning and project management.*

VALUE ANALYSIS: Value engineering, implementation procedure, enterprise resource planning and supply chain management.

PROJECT MANAGEMENT: PERT, CPM – differences & applications, critical path, determination of floats, importance, project crashing, smoothing and numerical examples.

Learning Outcome: *Upon completion of the topics the student will learn about enterprise planning and project management.*

TEXT BOOKS:

1. Industrial Engineering and management by O.P Khanna, Khanna Publishers.
2. Industrial Engineering and Production Management, Martand Telsang, S.Chand & Company Ltd. New Delhi.

REFERENCE BOOKS:

1. Industrial Management by Bhattacharya DK, Vikas publishers.
2. Operations Management by J.G Monks, McGrawHill Publishers.
3. Industrial Engineering by Banga & Sharma.
4. Principles of Management by Koontz O‟ Donnel, McGraw Hill Publishers.
5. Statistical Quality Control by Gupta.
6. Industrial Engineering and Management by Raju, Cengage Publishers.
7. http://www.nptelvideos.in/2012/12/industrial-engineering.html
8. http://nptel.ac.in/courses/112107143/1
9. http://nptel.ac.in/courses/112107143/2
10. http://nptel.ac.in/courses/112107143/3
11. http://nptel.ac.in/courses/112107143/9
12. http://nptel.ac.in/courses/112107143/10

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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II year II semester -16ME4L04

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FLUID MECHANICS & HYDRAULIC MACHINES LAB

Course Objective:

To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

Course Outcomes:

On completion of this course, students should be able to gain knowledge about the practical applications of fluid mechanics in real field, able to understand characteristic behavior of turbo-machinery under various working conditions.

List of Experiments:

1. Impact of jet on vanes
2. Performance test on Pelton wheel-constant head
3. Performance test on Pelton wheel-constant speed
4. Performance test on Francis turbine-constant head
5. Performance test on Francis turbine-constant speed
6. Performance test on single stage centrifugal pump
7. Performance test on multi stage centrifugal pump
8. Performance test on Reciprocating pump
9. Calibration of Venturimeter
10. Calibration of Orificemeter
11. Determination of Friction factor for a given pipe line

Note: Any 10 of the above 11 experiments are to be conducted.

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II year II semester -16ME4L05

L	T	P	C
-	-	3	2

PRODUCTION TECHNOLOGY LAB

Course Objective:

To impart hands-on practical exposure on manufacturing processes and equipment.

Course Outcomes:

The students will be able to make the pattern , mould and casting, able to do the arc welding, spot welding and brazing, injection and blow molding, able to do the metal forming and powder metallurgy test

I. METAL CASTING:

1.Pattern Design and making - for one casting drawing.
2.Sand properties testing - for strength and permeability
3.Mould preparation, Melting and Casting

II. WELDING:

1. Manual metal arc welding - Lap & Butt Joints
2. Resistance Spot Welding
3. Brazing and soldering
2. Gas cutting
4. TIG/MIG Welding
5. Gas welding

III. METAL FORMING AND POWDER METALLURGY:

1. Blanking & Piercing operations and study of simple, compound and progressive dies.
2. Deep drawing and extrusion operations.
3. Bending and other operations
4. Basic powder compaction and sintering

IV. PROCESSING OF PLASTICS:

1.Injection Moulding
2.Blow Moulding

NOTE: Each Trade should be minimum 2 Experiments and total will be 10 experiments.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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III Year – I Semester

L	T	P	C
4	**0**	**0**	**3**

DYNAMICS OF MACHINERY (16ME5T16)

Course Objectives:

1. *To understand the effect of precession on the stability of moving vehicles and force analysis of planar mechanisms.*
2. *To apply the knowledge of friction on clutches, brakes and dynamometers.*
3. *To equip the knowledge of solving problems concerned with dynamic force analysis and concept of flywheel.*
4. *To understand various types of governors.*
5. *To impart the knowledge on balancing of rotary and reciprocating masses.*
6. *To equip the knowledge on vibrations and their importance in design.*

UNIT – I

INTRODUCTION: Static and dynamic force analysis of planar mechanisms

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.(Demonstration of models in video show).

UNIT – II

FRICTION-CLUTCHES: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, film lubrication. Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle.

General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission.

UNIT – III

TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism**,** inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.

UNIT-IV

GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronism and hunting.

UNIT – V

BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. Analytical and graphical methods, unbalanced forces and couples – examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT – VI

VIBRATIONS: Free Vibration of spring mass system –Natural frequency-types of damping – damped free vibration, Simple problems on forced damped vibration, vibration isolation and transmissibility transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's methods, Raleigh's method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

Text Books:

1. Theory of Machines / S.S Rattan/ Mc. Graw Hill, 2014
2. Mechanism and machine theory /Ashok G. Ambedkar/PHI Publications.

References:

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Theory of Machines / Shigley / MGH
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of machines / Khurmi/S.Chand.
5. https://www.youtube.com/watch?v=Ru2FnaHpr-4
6. https://www.youtube.com/watch?v=FydJu1A1oeM
7. https://www.youtube.com/watch?v=fEdz91oWrts
8. https://www.youtube.com/watch?v=na90uKzc9JY
9. http://nptel.ac.in/courses/112105164/16
10. https://www.youtube.com/watch?v=FA04XFpJgwE
11. http://nptel.ac.in/courses/112105124/40
12. http://nptel.ac.in/syllabus/112104114/
13. https://www.youtube.com/watch?v=ChN6yUzgBbs
14. http://nptel.ac.in/courses/112104114/
15. https://www.youtube.com/watch?v=tJNaPt5aPmg

Course outcomes:

Student should be able to

CO#	Statement	Cognitive Level
CO1	*analyze the stabilization of sea vehicles, aircrafts and automobiles.*	
CO2	*apply the concept of friction in clutches, brakes and dynamometers.*	
CO3	*analyze the dynamic forces of slider crank mechanism and design of flywheel.*	
CO4	*compare various governors and their mechanisms for controlling the speed of the engines.*	
CO5	*analyze the balancing of rotary and reciprocating masses.*	
CO6	*analyze the effect of vibration on beams and shafts with various load distributions.*	

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III Year – I Semester

L	T	P	C
4	**0**	**0**	**3**

METAL CUTTING & MACHINE TOOLS (16ME5T17)

Course Objectives:

1. *To provide the fundamental knowledge and principles in material removal processes.*
2. *To apply the fundamentals and principles of metal cutting to practical applications through machine tools.*
3. *To demonstrate the fundamentals of machining processes and machine tools.*
4. *To develop knowledge and importance of metal cutting parameters.*
5. *To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.*
6. *To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.*

UNIT – I

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

UNIT – II

LATHE: Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – box tools taper turning, thread turning – for lathes and attachments, constructional features of speed gear box and feed gear box. 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 for automats.

UNIT – III

SHAPING, SLOTTING AND PLANING MACHINES: Principles of working – principal parts – specifications, operations performed, machining time calculations.

DRILLING & BORING MACHINES: Principles of working, specifications, types, operations performed – tool holding devices types of drills – Boring Machines – fine Boring Machines – jig boring machine, deep hole Drilling Machine.

UNIT – IV

MILLING MACHINES: Principles of working – specifications – classification of Milling Machines – Principle features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories to milling machines.

UNIT – V

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

UNIT – VI

JIGS & FIXTURES: Principles of design of jigs and fixtures and uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, typical examples of jigs and fixtures.

CNC MACHINE TOOLS: CNC Machines, working principle, classification, constructional features of CNC machines, CNC controller, types of motion controls in CNC machines, applications of CNC machines.

TEXT BOOKS:

1. Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill
2. Workshop Technology – B.S.RaghuVamshi – Vol II
3. Production Engineering-P.C.Sharma, S.Chand & Company Ltd
4. A text book of Manufacturing Technology (manufacturing Processes) by R.K.Rajput Lakshmi Publications(p) Ltd.

REFERENCES:

1. Metal cutting Principles by M.C. Shaw
2. Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis
3. Production Technology by H.M.T. (Hindustan Machine Tools).
4. A text book of Production Engineering by K.C.Jain & A.K.Chaitale PHI learning Private Limited.
5. Manufacturing Processes for Engineering Materials-Kalpakjian S & Steven R Schmid/Pearson Publications 5th Edition
6. **http://nptel.ac.in/courses/112105126/1**
7. **http://nptel.ac.in/courses/112105126/5**
8. **http://nptel.ac.in/courses/112105126/10**
9. **http://nptel.ac.in/courses/112105126/25**

Course Outcomes:

Students will be able to:

CO#	Statement	Cognitive Level
CO1	*apply the fundamentals of metal removal processes, metal cutting forces and geometry of the cutting tools.*	
CO2	*explain the working principle, mechanism and various operations performed on lathe*	
CO3	*compare the mechanisms of shaper, slotter, planer and various operations performed by drilling and boring machines*	
CO4	*explain the working principle of milling machines and its accessories.*	
CO5	*summarize different finishing processes.*	
CO6	*design jigs and fixtures for simple parts; understand the working of cnc machines.*	

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III Year – I Semester	L	T	P	C
	4	**0**	**0**	**3**

DESIGN OF MACHINE MEMBERS –II (16ME5T18)

Course Objectives:

To give the clear idea about

1. *Various bearings and designing procedures.*
2. *Design and analysis of the engine parts.*
3. *Stresses induced in curved beams of various cross sections.*
4. *Design and analysis of power screws.*
5. *Power transmission through gears.*
6. *Power transmission through pulleys and wire ropes.*

UNIT – I

BEARINGS: Classification of bearings- applications, types of journal bearings – lubrication – Petroff's Equation– bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life.

UNIT – II

ENGINE PARTS: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts - strength and proportions of over hung and center cranks – crank pins, crank shafts. Pistons, forces acting on piston – construction design and proportions of piston, cylinder, cylinder liners

UNIT – III

Design of curved beams: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and T-section, design of crane hooks, C –clamps**.**

UNIT – IV

DESIGN OF POWER SCREWS: Design of screw, square ACME, buttress screws, design of nut, compound screw, differential screw, Screw Jack.

UNIT – V

SPUR & HELICAL GEAR DRIVES: Spur gears- helical gears – load concentration factor – dynamic load factor, surface compressive strength – bending strength – design analysis of spur gears – estimation of centre distance, module and face width, check for plastic deformation, check for dynamic and wear considerations.

UNIT – VI

POWER TRANSMISSIONS SYSTEMS:

Transmission of power by belt and rope drives, transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives.

Wire Ropes: Construction, Designation, Stresses in wire ropes, rope sheaves and drums.

Text Books:

1. Machine Design/V.Bandari/TMH Publishers 2015.
2. Machine Design/T.V. Sundararajamoorthy/N. Shanmugam
3. Design Data Book/PSG College of Technology 2012
4. Machine Design Data Book by S.Md.Jalaludeen.

References:

1. Machine Design: An integrated Approach / R.L. Norton / Pearson Education
2. Mech. Engg. Design / JE Shigley/Tata McGraw Hill education
3. Machine Design, Volume-1 & 2 by S.Md.Jalaludeen.
4. http://nptel.ac.in/courses/112102015/28
5. http://nptel.ac.in/courses/112104203/31
6. http://nptel.ac.in/courses/112106137/25
7. http://nptel.ac.in/courses/105106049/lecnotes/mainch10.html
8. http://nptel.ac.in/courses/112105124/

Course outcomes:

Student should be able to

CO#	Statement	Cognitive Level
CO1	*design the suitable bearing based on the application of the loads and predict the life of the bearing.*	
CO2	*design the engine parts like piston, cylinder, connecting rod and crankshaft.*	
CO3	*design the curved beams with different cross section.*	
CO4	*design of power screws.*	
CO5	*design the spur and helical gear drive for power transmission based on plastic deformation, dynamic and wear considerations*	
CO6	*design power transmission elements such as belts, chains, pulleys and wire ropes.*	

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III Year – I Semester

L	T	P	C
4	**0**	**0**	**3**

OPERATIONS RESEARCH (16ME5T19)
(Only for ME)

Course Objectives:

To make the students learn about

1. *Applications of operations research through LPP.*
2. *Formulation of objective function through transportation and assignment problems.*
3. *How to sequence the jobs and machines while processing and Replacement of machine / equipment.*
4. *How to calculate the optimal strategies of players and applications of waiting line problems.*
5. *Deterministic and stochastic models*.
6. *Applications of operations research through DPP and simulation techniques*

UNIT – I

INTRODUCTION: Development – definition– characteristics and phases – types of operation research models – applications.

ALLOCATION: Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT – II

TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy,

ASSIGNMENT PROBLEM – formulation – optimal solution - variants of assignment problem-traveling salesman problem.

UNIT – III

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

REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT – IV

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

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

UNIT – V

INVENTORY: Introduction – single item – deterministic models –purchase inventory models with one price break and multiple price breaks – shortages are not allowed – stochastic models – demand may be discrete variable or continuous variable – instantaneous production. Instantaneous demand and continuous demand and no set up cost. ABC & VED Analysis.

UNIT – VI

DYNAMIC PROGRAMMING: Introduction – Bellman's principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

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

TEXT BOOKS:

1. Operations Research / S.D.Sharma-Kedarnath

REFERENCES:

1. Operations Research / A.M.Natarajan, P. Balasubramani, A.Tamilarasi / Pearson Education.
2. Operations Research / R.Pannerselvam,PHI Publications.
3. Operations Research / Wagner/ PHI Publications.
4. Operations Research/S Kalavathy / Vikas Publishers
5. Operations Research / DS Cheema/University Science Press
6. Operations Research / Ravindran, Philips, Solberg / Wiley publishers.
7. http://www.nptelvideos.in/2012/12/fundamentals-of-operations-research.html

Course Outcomes:

Student should be able to

CO#	Statement	Cognitive Level
CO1	*formulate the objective function by linear programming problem and solution through various models.*	
CO2	*evaluate optimal solutions to the objective function with the knowledge of transportation and assignment problems.*	
CO3	***a**pply in sequencing the jobs on a machine and items replacement**s***	
CO4	evaluate the best strategies and service rate.	
CO5	***a**pply inventory models in balancing the stock and demand ratio for profits*	
CO6	***a**pply the principle of dynamic programming and simulation techniques.*	

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III Year – I Semester

L	T	P	C
4	**0**	**0**	**3**

THERMAL ENGINEERING – II (16ME5T20)
(Use of steam tables and Mollier chart is allowed)

Course objective:

To make the students aware of:

1. *Basic components being used in steam power plant cycles and also the methods to improve the efficiency of the cycle.*
2. *Boilers, mountings and accessories being used in boilers and also the performance evaluation of boilers.*
3. *Selecting appropriate nozzle for maximum mass flow rate and steam turbine.*
4. *This unit is intended to provide basic knowledge of Steam Turbines and also its performance for maximum work output.*
5. *Gas turbines, various methods to improve their performance.*
6. *Basic principle for jet propulsion, rocket and their performance evaluation.*

UNIT – I

BASIC CONCEPTS: Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating.

UNIT II

BOILERS : Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories – working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – draught, classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

UNIT – III

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

STEAM CONDENSERS: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement.

UNIT IV

STEAM TURBINES: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency. 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 – calculation of blade height.

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, types of combustion chambers.

UNIT – VI

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 engines – needs and demands met by turbo jet – schematic diagram, thermodynamic cycle, performance evaluation, thrust augmentation – methods.

Rockets : Application – working principle – classification – propellant type – thrust, propulsive efficiency – specific impulse – solid and liquid propellant rocket engines.

TEXT BOOKS:

1. Thermal Engineering – R K Rajput-Lakshmi Publications.
2. Gas Turbines – V.Ganesan /TMH
3. Thermodynamics and Heat Engines, Volume 2 - R.Yadav- Central book depot.

REFERENCES:

1. Gas Turbines and Propulsive Systems – P.Khajuria & S.P.Dubey - /Dhanpatrai
2. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley– Longman
3. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
4. Thermal Engineering-P.L.Ballaney/ Khanna publishers.
5. Thermal Engineering-M.L.Marthur & Mehta/Jain bros
6. Heat Engineering – V.P Vasandani and D.S Kumar- Metropolitan Book Company, New Delhi
7. **http://nptel.ac.in/courses/112106133/**
8. **http://nptel.ac.in/courses/112106133/3**
9. **http://nptel.ac.in/courses/112106133/13**
10. **http://nptel.ac.in/courses/112106133/14**
11. **http://nptel.ac.in/courses/112106133/16**

Course outcomes:

The student willable to:

CO#	Statement	Cognitive Level
CO1	*apply the knowledge of steam power plant cycles for the generation of power.*	
CO2	*summarize the working of various boilers and their performance.*	
CO3	*design a steam nozzle for maximum mass flow rate.*	
CO4	*evaluate steam turbines for better efficiency.*	
CO5	*evaluate gas turbines and various methods to improve performance.*	
CO6	*explain the working of jet propulsion and rocket engineering.*	

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III Year – I Semester

L	T	P	C
0	**0**	**3**	**2**

THEORY OF MACHINES LAB (16ME5L06)

Course objective:

To impart practical knowledge of mechanisms for the types of motion in a machine; determine static and dynamic response of machine elements.

List of experiments

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyze the motion of a motorized gyroscope when the couple is applied along its spin axis.
4. To determine the frequency of undamped free vibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system.
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel.
8. To plot follower displacement Vs cam rotation for various Cam Follower systems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism.
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage, velocity ratio and efficiency.
12. To study various types of gears- Spur, Helical, Worm and Bevel Gears.

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

Course outcome:

Students will be able to make use of the principles of static and dynamic motions of machinery.

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(Autonomous)

III Year – I Semester

L	T	P	C
0	**0**	**3**	**2**

MACHINE TOOLS LAB (16ME5L07)

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.

1. Introduction of general purpose machines
   - Lathe, - Drilling Machine
   - Milling Machine - Shaper
   - Planing Machine - Slotting Machine
   -Tool and Cutter Grinder -Cylindrical grinder
   -Surface Grinder.
2. Plain turning and facing operations on lathe. (To be discussed)
3. Step turning and taper turning operation on lathe.
4. Thread cutting and knurling operation on lathe.
5. Drilling operation on lathe

Fundamental operations on

6. Drilling and tapping.
7. Shaping and planning.
8. Slotting.
9. Milling.
10. Cylindrical surface grinding.
11. Grinding of tool angles.
12. Introduction of CNC machine tools

Note: Any 10 of the above 11 experiments are to be conducted.

Course outcome:

The students can operate different machine tools with understanding of work holders and operating principles to produce different part features to the desired quality.

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III Year – I Semester

L	T	P	C
0	**0**	**3**	**2**

THERMAL ENGINEERING LAB (16ME5L08)

Course objective:

*To provide hands on experience in operating various types of internal combustion engines and understands their functioning and performance***.**

1. I.C. Engines valve / port timing diagrams.
2. I.C. Engines performance test (4 -stroke diesel engines)
3. I.C. Engines performance test on 2-stroke petrol.
4. Evaluation of friction power by conducting morse test on 4-stroke multi Cylinder petrol engine.
5. Determination of friction power by retardation and motoring test on IC engine.
6. I.C. Engines heat balance.
7. Economical speed test of an IC engine.
8. Performance test on variable compression ratio engines.
9. Performance test on reciprocating air compressor unit.
10. Study of boilers
11. Dis-assembly / assembly of Engines.
12. Load test on 4 - stroke single cylinder variable compression ratio petrol engine.
13. Performance test on Refrigeration test rig.

Note: Any 10 of the above 13 experiments are to be conducted.

Course Outcomes:

The student will be able to evaluate the performances of IC Engines and compressors.

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III Year – I Semester

L	T	P	C
0	2	0	0

INTELLECTUAL PROPERTY RIGHTS AND PATENTS (16BH5T16)

UNIT-I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics - Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration –WTO-WIPO- Regulatory – Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues.

UNIT-II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law- Semiconductor Chip Protection Act.

UNIT-III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Product Patent and Process Patent- Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – New developments in Patent Law

UNIT-IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

UNIT-V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation- Service Level Agreements – Breach of Contract – Applying State Law.

UNIT-VI

Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Security -Data Security – Confidentiality – Data Privacy in India Vs Rest of the World.
Relevant Cases Shall be dealt where ever necessary.

REFERENCE BOOKS:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi.
2. Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, New Delhi.
3. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press).
4. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections.
5. Prabhuddha Ganguli: ‘Intellectual Property Rights” Tata Mc-Graw – Hill, New Delhi.
6. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
7. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
8. M.Ashok Kumar and Mohd.Iqbal Ali: “Intellectual Property Right” Serials Pub.

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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III Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

METROLOGY (16ME6T21)

Course objectives:

The students will learn

1. *Basic knowledge of tolerance, limits and standard systems of the fits.*
2. *Various measurements of standards, angle, and limit gauges.*
3. *Various principles of measuring instruments and interference of light devices..*
4. *Surface texture measurement and various types of comparators.*
5. *Inspection of Spur Gear and thread elements.*
6. *Machine tool testing to evaluate machine tool quality*

UNIT-I

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

UNIT-II

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

MEASUREMENT OF ANGLES AND TAPERS:

Different methods – bevel protractor, angle slip gauges- angle dekkor- spirit levels- sine bar- sine table, rollers and spheres used to measure angles and tapers.

LIMIT GAUGES: Taylor's principle – design of Go and No Go gauges; plug, ring, snap, gap, taper, profile and position gauges.

UNIT-III

Optical Measuring Instruments: Tools maker's microscope and uses - autocollimators, optical projector, optical flats and their uses.

Interferometry: Interference of light, Michelson's interferometer, NPL flatness interferometer, and NPL gauge interferometer.

UNIT-IV

Comparators: Types - mechanical, optical, electrical and electronic, pneumatic comparators and their uses.

Surface Roughness Measurement: Differences between surface roughness and surface waviness –Numerical assessment of surface finish-CLA, Rt., R.M.S. Rz, R10 values, Method of measurement of surface finish – Profilograph, Talysurf, ISI symbols for indication of surface finish.

UNIT – V

Gear Measurement: Nomenclature of gear tooth, tooth thickness measurement with gear tooth vernier & flange micro meter, pitch measurement, total composite error and tooth to tooth composite errors, rolling gear tester, involute profile checking.

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

UNIT – VI

Flatness and Straightness Measurement: Measurement of flatness of surfaces- instruments used- straight edges-surface plates.

Machine Tool Alignment Tests: Principles of machine tool alignment testing on lathe, drilling and milling machines.

TEXT BOOKS:

1. Engineering Metrology by R.K.Jain / Khanna Publishers
2. Engineering Metrology by I.C.Gupta / Dhanpat Rai Publishers

REFERENCE BOOKS:

1. Dimensional Metrology, Connie Dotson, Cengage Learning.
2. Engineering Metrology by Mahajan / Dhanpat Rai Publishers
3. Engineering Metrology by KL Narayana, Scitech publishers.
4. A Text Book of Production Engineering, P.C. Sharma, S. Chand Pub.
5. Engineering Metrology and Measurements by NV Raghavendra, L Krishna murthy, Oxford publishers.
6. http://site.iugaza.edu.ps/aabuzarifa/files/METRO20152_CH52.pdf
7. http://home.iitk.ac.in/~nsinha/Metrology.pdf
8. http://site.iugaza.edu.ps/aabuzarifa/files/METRO20152_CH4.pdf
9. http://site.iugaza.edu.ps/aabuzarifa/files/METRO20152_CH61.pdf
10. https://getmyuni.azureedge.net/assets/main/study-material/notes/mechanical_engineering_mechanical-measurements-and-metrology_interferometer-and-screw-thread-gear-measurement_notes.pdf
11. http://nptel.ac.in/courses/112106179/10
12. http://nptel.ac.in/courses/112106179/17
13. http://nptel.ac.in/courses/112106179/23
14. http://nptel.ac.in/courses/112106179/31
15. http://nptel.ac.in/courses/112106179/32
16. http://nptel.ac.in/courses/112106179/35
17. http://nptel.ac.in/courses/112106179/37

Course outcomes:
Students will be able to

CO#	Statement	Cognitive Level
CO1	*design tolerances and fits for selected product quality*	
CO2	*illustrate standards of length, angles and various types of limit gauges.*	
CO3	*choose appropriate method from various optical measuring instruments for inspection of surface flatness.*	
CO4	*evaluate surface finish and measure the parts with various comparators.*	
CO5	*choose appropriate method and instruments for inspection of various gear elements and thread elements.*	
CO6	*evaluate the surface flatness and quality of the machine tool with alignment test.*	

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III Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

INSTRUMENTATION & CONTROL SYSTEMS (16ME6T22)

Course Objectives:

1. *To impart the knowledge of basic principles of measurement and displacement.*
2. *To enable students, apply the principles of measuring temperature and pressure.*
3. *To enable student, Measure level, flow, speed, acceleration and vibration with the help of suitable instruments.*
4. *To make the student, identify the suitable instruments to measure stress and strain.*
5. *To make the student, to choose the appropriate instruments to measure humidity level, force, torque and power.*
6. *The student should be able to learn what are the control system and their purpose.*

UNIT – I

Definition – Basic principles of measurement – measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. definitions and basic concepts of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity. Dynamic performance characteristics – sources of error, classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures.

UNIT – II

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

MEASUREMENT OF PRESSURE: Units – classification – different principles used. manometers, piston, bourdon pressure gauges, bellows – diaphragm gauges. low pressure measurement – thermal conductivity gauges– ionization pressure gauges, mcleod pressure gauge. Knudsen gauge.

UNIT – III

MEASUREMENT OF LEVEL: Direct method – indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – bubler level indicators.

FLOW MEASUREMENT: Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, laser doppler anemometer (LDA).

MEASUREMENT OF SPEED : Mechanical tachometers – electrical tachometers – stroboscope, noncontact type of tachometer

MEASUREMENT OF ACCELERATION AND VIBRATION: Different simple instruments– principles of seismic instruments – vibrometer and accelerometer using this principle.

UNIT – IV

Stress Strain Measurements: Various types of stress and strain measurements – 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.

UNIT – V

MEASUREMENT OF HUMIDITY – Moisture content of gases, sling psychrometer, absorption psychrometer, dew point meter.

MEASUREMENT OF FORCE, TORQUE AND POWER- Elastic force meters, load cells, torsion meters, dynamometers.

UNIT – VI

ELEMENTS OF CONTROL SYSTEMS: Introduction, importance – classification – open and closed loop systems, servomechanisms–examples with block diagrams–temperature, speed & position control systems.

TEXT BOOKS:

1. Measurement Systems: Applications & design by D.S Kumar, PHI
2. Mechanical Measurements / BeckWith, Marangoni,Linehard, PHI / PE.

REFERENCES:

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh/ TMH.
2. Experimental Methods for Engineers / Holman.
3. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
4. Instrumentation, measurement & analysis by B.C.Nakra & K.K.Choudhary, TMH.
5. Mechanical Measurements by R.S. Sirohi and Radha Krishnan, Jain Publications, 2009.
6. http://www.nptelvideos.in/2012/11/process-control-and-instrumentation.html
7. https://www.youtube.com/watch?v=jnY9T4Bf9h8
8. https://www.youtube.com/watch?v=YZxY9k3yHrw

Course outcomes:

Student will be able to

CO#	Statement	Cognitive Level
CO1	*analyze the performance characteristics of the instrument and will choose the suitable instrument to measure displacement.*	
CO2	*select the appropriate instruments to measure temperature and pressure.*	
CO3	*measure level, flow, speed, acceleration and vibration with the help of suitable instruments.*	
CO4	*identify the suitable instruments to measure stress and strain.*	
CO5	*choose the appropriate instruments to measure humidity level, force, torque and power.*	
CO6	*analyze the measuring system with the help of control systems.*	

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III Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

REFRIGERATION & AIR CONDITIONING (16ME6T23)
(Refrigeration and Psychrometric tables and charts allowed)

Course Objective:

1. *To impart basic knowledge of refrigeration, study air refrigeration cycles and aircraft refrigeration.*
2. *To make students aware of vapour compression systems and usage of p-h charts.*
3. *To study various components used in VCR systems and types of refrigerants.*
4. *To make students aware of vapour absorption system and Steam jet refrigeration system.*
5. To impart knowledge of psychrometric properties, processes used in air-conditioning.
6. *To study requirements of human comfort and different components used in air conditioning systems.*

UNIT I

INTRODUCTION TO REFRIGERATION: Necessity and applications –unit of refrigeration and C.O.P.

REFRIGERATION: Mechanical refrigeration -types of ideal cycles of refrigeration air refrigeration: bell Coleman cycle - open and dense air systems – refrigeration systems used in air craft's and problems.

UNIT II

VAPOUR COMPRESSION REFRIGERATION SYSTEM:

Working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – actual cycle influence of various parameters on system performance – use of p-h charts – numerical problems.

UNIT III

REFRIGERANTS – Desirable properties – classification - refrigerants used - nomenclature – ozone depletion – global warming.

VCR SYSTEM COMPONENTS: Compressors – general classification –comparison – advantages and disadvantages. condensers – classification – working principles evaporators – classification – working principles, expansion devices – types – working principles.

UNIT IV

VAPOUR ABSORPTION SYSTEM:

Calculation of maximum COP –description and working of NH_3 – water system and Li Br –water (Two shell & Four shell) System, principle of operation three fluid absorption system, salient features.

STEAM JET REFRIGERATION SYSTEM: Working Principle and Basic Components

NONCONVENTIONAL REFRIGERATION METHODS: Principle and operation of (i)Thermoelectric refrigerator (ii) Vortex tube

UNIT – V

INTRODUCTION TO AIR CONDITIONING: Psychometric properties &processes – characterization of sensible and latent heat loads — need for ventilation, consideration of infiltration – load concepts of RSHF, GSHF-problems, concept of ESHF and ADP temperature,

air conditioning load calculations .

UNIT – VI

HUMAN COMFORT: Requirements of human comfort and concept of effective temperature-comfort chart –comfort air conditioning – requirements of industrial air conditioning.

AIR CONDITIONING SYSTEMS: Classification of equipment, filters, grills and registers, fans and blowers. heat pump – heat sources – different heat pump circuits.

TEXT BOOKS:

1. C. P. Arora., Refrigeration and air conditioning - TMH
2. Domkundwar, S. C. Arora, *A Course in Refrigeration and Air conditioning*, Dhanpatrai Publications, New Delhi, India.

REFERENCES

1. Manohar Prasad, Refrigeration and Air conditioning, New Age international
2. Refrigeration and Air Conditioning by R K Rajput, S K kataria& sons
3. R. Dossat, Principles of Refrigeration - - Pearson
4. Refrigeration and Air conditioning,R.S.khurmi
5. **http://nptel.ac.in/courses/112106133/23**
6. **http://nptel.ac.in/courses/112106133/28**
7. **http://nptel.ac.in/courses/112106133/30**
8. **http://nptel.ac.in/courses/112106133/31**
9. **http://nptel.ac.in/courses/112106133/32**

DATA BOOKS

1. Refrigeration and Air Conditioning Data book-Domakundwar&Domakundwar / Dhanpathi rai & CO
2. Refrigeration and Air Conditioning Data book, CP Kothandaraman /New age publishers

Course Outcome:

Student will be able to:

CO#	Statement	Cognitive Level
CO1	*demonstrate the importance of different refrigeration systems and air refrigeration systems in aircrafts.*	
CO2	*discuss about vapour compression refrigeration and its performance using p-h charts.*	
CO3	*discuss about different components and refrigerants used in vapour compression refrigeration system.*	
CO4	*explain about vapour absorption system and steam jet refrigeration systems.*	
CO5	*perform cooling load calculations and select the appropriate process equipment for air-conditioning.*	
CO6	*demonstrate types of air conditioning systems.*	

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

III Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

HEAT TRANSFER (16ME6T24)

***Course Objectives**:*

1. *To learn the basic differential equations of heat transfer in various modes.*
2. *To acquire the knowledge of heat transfer and temperature distribution of various fins.*
3. *To understand dimensional analysis and its applications for developing semi empirical non-dimensional correlations.*
4. *To apply empirical correlations for both forced and free convection to determine values for the convection heat transfer coefficient.*
5. *To learn about boiling, condensation and the concepts of LMTD, NTU for heat exchangers*
6. To learn about the concepts of radiation heat transfer.

UNIT – I

INTRODUCTION: Modes and mechanisms of heat transfer – basic laws of heat transfer – General discussion about applications of heat transfer.

CONDUCTION HEAT TRANSFER: Fourier equation – general heat conduction equation in cartesian, cylindrical and Spherical coordinates. Steady, unsteady and periodic heat transfer – initial and boundary conditions.

ONE DIMENSIONAL STEADY STATE CONDUCTION HEAT TRANSFER: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – critical radius of insulation-Variable thermal conductivity – systems with heat sources or heat generation,

UNIT – II

Extended surface (fins) heat Transfer – long fin, fin with insulated tip and short fin, application to error measurement of temperature.

ONE DIMENSIONAL TRANSIENT CONDUCTION HEAT TRANSFER: Systems with negligible internal resistance – significance of biot and fourier numbers - chart solutions of transient conduction systems

UNIT – III

CONVECTIVE HEAT TRANSFER: Classification of convective heat transfer – dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem for forced and free convection, application for developing semi – empirical non- dimensional correlation for convective heat transfer – Significance of non-dimensional numbers – concepts of continuity, momentum and Energy Equations.

UNIT –IV

FORCED CONVECTION

EXTERNAL FLOWS: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -flat plates and cylinders.

INTERNAL FLOWS: Concepts about hydrodynamic and thermal entry lengths – division of internal flow based on this –use of empirical relations for horizontal pipe flow and annulus flow.

FREE CONVECTION: Development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for vertical plates and pipes.

UNIT V
HEAT TRANSFER WITH PHASE CHANGE
BOILING: Pool boiling – regimes- calculations on nucleate boiling, critical heat flux and film boiling.
CONDENSATION: Film wise and drop wise condensation –Nusselt's theory of condensation on a vertical plate - film condensation on vertical and horizontal cylinders using empirical correlations.

HEAT EXCHANGERS:
Classification of heat exchangers – overall heat transfer coefficient and fouling factor – concepts of LMTD and NTU methods – Problems.

UNIT VI
RADIATION 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 grey bodies – radiation shields – electrical analogy for radiation networks.

DATA HAND BOOK

1. C.P. Kothandaraman and Subramanian Heat and Mass Transfer Data Book, New Age International Publications, 7th Edition, Reprint 2012

TEXT BOOKS:

1. R.C.Sachdeva -Fundamentals of Engineering Heat and Mass Transfer —New Age Intl. Publishers 2ndEdition, 2005
2. P.K.Nag, Heat and Mass Transfer- TMH 2nd Edition, 2007
3. Heat and Mass Transfer by R.K.Rajput, S.Chand Publications 3rd Edition.

REFERENCES:

1. J.P.Holman, Heat transfer - Tata McGraw-Hill, 9th Edition, 2010
2. Yunus. A. Cengel, Heat & Mass Transfer-A Practical Approach – Tata McGraw Hill, 4th Edition, 2012
3. P.S.Ghoshdastidar Heat Transfer - Oxford Higher Education 6th Edition 2011.
4. C.P.Kothandaraman and Subramanian, Heat and Mass Transfer, New Age International Publications 7th Edition 2010.
5. www.nptelvideos.in/2012/11/heat-transfer.html
6. https://youtu.be/qa-PQOjS3zA
7. https://www.youtube.com/watch?v=qa-PQOjS3zA

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***Course Outcomes**:*
Students will be able to:

CO#	Statement	Cognitive Level
CO1	*analyze the basic heat transfer concepts and their practical relevance in planes, cylinders and spherical components.*	
CO2	*analyze the concepts of heat transfer and temperature distribution of various fins.*	
CO3	*demonstrate dimensional analysis and its applications for developing semi empirical non-dimensional correlations.*	
CO4	*analyze empirical correlations for both forced and free convection to determine values for the convection heat transfer coefficient.*	
CO5	*evaluate the performance of heat exchangers using lmtd, ntu.*	
CO6	discuss the concepts of radiation heat transfer	

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III Year – II Semester

L	T	P	C
4	0	0	3

DATABASE MANAGEMENT SYSTEMS (16CS6E04)
(Common to Civil Engineering and Mechanical Engineering)

Learning Objectives:

Provide students with necessary skills for designing and development of databases for real world applications.

Course Outcomes:

CO#	Statement	Cognitive Level
CO1	Identify the role of Database Management System for maintenance of Databases(Apply)	
CO2	Apply Relational Model to design and manipulate a Database. (Apply)	
CO3	Convert Entity relationship model into Relational Model (Apply)	
CO4	Implement SQL for a given problem. (Create)	
CO5	Design a Database using Normalization techniques(Create)	
CO6	Determine Database transactions as per concurrency and ACID properties(Evaluate)	

UNIT – I: INTRODUCTION

Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Data base systems, Database applications.
Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment.

UNIT – II:

RELATIONAL MODEL: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Logical Data Base Design.

BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations.

UNIT – III:

Entity Relationship Model: Introduction to ER Model, Data Base Design, Representation of entities, attributes, entity set, relationship, relationship set, Additional Features of ER Model: constraints, sub classes, super class, Strong and Weak entities, inheritance, specialization, generalization, Aggregation.

UNIT – IV:

SQL: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, concepts of views, relational set operations.

UNIT – V:

SCHEMA REFINEMENT (NORMALIZATION): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF).

UNIT – VI:

TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, uncommitted data, inconsistent retrievals. Concurrency control with locking methods: lock granularity, lock types, two phase locking for ensuring serializability.

Text Books:

1."Database Management Systems", Raghuram Krishnan, Johannes Gehrke, TMH3rd edition, 2003.

2. "Database Management System", RamezElmasri, Shamkant B. Navathe, PEA, 6th edition, 2016.

Reference Books:

1. "Database System Concepts,"Silberschatz, Korth, TMH, 5th edition, 2011.
2. "Introduction to Database Systems," C J Date, PEA, 8th edition, 2004.
3. "The Database book principles & practice using Oracle/MySql," NarainGehani, Silicon Press, 2011

Web Resources:

1. **http://nptel.ac.in/courses/106106093 (Prof. D. Janakiram, IIT, Madras)**.

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(Autonomous)

III Year-II Semester

L	T	P	C
4	0	0	3

WASTE WATER MANAGEMENT (16CE6E01)
(OPEN ELECTIVE)

Course Learning Objectives:

The course will address the following:

- Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation.
- To impart knowledge on selection of treatment methods for industrial waste water.
- To know the common methods of treatment in different industries.
- To acquire knowledge on operational problems of common effluent treatment plant.

Course Outcomes:

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

CO#	Statement	Cognitive Level
CO1	Analyse the industrial waste quantity and quality requirements.	Analyse
CO2	Identify the treatment methods for industrial wastewater	Applying
CO3	Know the basic theories of industrial waste water management.	Remembering
CO4	Decide the need of common effluent treatment plant forthe industrial area in their vicinity	Evaluating
CO5	Examine the effects and treatment methods of liquid waste from the manufacturing industries	Apply
CO6	Examine the effects and treatment methods of liquid waste from the food industries.	Apply

SYLLABUS:

UNIT – I

Industrial water Quantity and Quality requirements: Boiler and cooling waters–Process water for Textiles, Food processing, Brewery Industries, power plants, fertilizers, sugar mills.

UNIT – II

Miscellaneous Treatment: Use of Municipal wastewater in Industries – Advanced water treatment - Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, elutriation, Removal of Iron and Manganese, Removal of Colour and Odour.

UNIT – III

Basic theories of Industrial Wastewater Management: Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis - Civil Engineering Wastewater characterization-Toxicity of industrial effluents-Treatment of wastewater-unit operations and processes-Volume and Strength reduction – Neutralization – Equalization and proportioning- recycling, reuse and resources recovery.

UNIT – IV

Industrial wastewater disposal management: discharges into Streams, Lakes and oceans and associated problems, Land treatment – Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastes- Effluent Disposal Method.

UNIT – V

Process and Treatment of specific Industries-1: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants.

UNIT – VI

Process and Treatment of specific Industries-2: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Pharmaceutical Plants.

Text book:

1. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, New Delhi.
2. Industrial Wastewater Treatment by KVSG Murali Krishna.
3. Industrial Wastewater treatment by A.D. Patwardhan, PHI Learning, Delhi.
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3rd Edition.

References:

1. Industrial Water Pollution Control by W. Wesley Eckenfelder, Mc- GrawHill, Third Edition.
2. Wastewater Engineering by Metcalf and Eddy Inc., Tata Mc- Grawhill Co., New Delhi.
3. Wastewater Treatment- Concepts and Design Approach by G.L. Karia& R.A. Christian, Prentice Hall of India.
4. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard, Cengage Learning.

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(Autonomous)

III Year - II Semester

L	T	P	C
4	0	0	3

COMPUTER GRAPHICS (16CS6E05)
(Mechanical Engineering)

Learning objectives

1. Understand the fundamental concepts and theory of computer graphics.
2. Understand modeling, and interactive control of 3D computer graphics applications.
3. The underlying parametric surface concepts be understood.

Course Outcomes:

At the end of this course, student will be able to-

CO#	Statement	Cognitive Level
CO1	Interpret the fundamentals of computer graphics and working principles of input output devices(Evaluate)	
CO2	Apply Algorithms for drawing line, circle and filling along with 2-D geometric transformations.(Apply)	
CO3	Select algorithm for clipping and viewport object representation relation to images displayed on screen. (Apply)	
CO4	Analyze representation of 3 dimensional objects. (Analyze)	
CO5	Design of surface detection method by using invariant 3-D transformations (Create)	
CO6	Design of animation sequences using motion oriented graphics. (Create)	

UNIT-I

INTRODUCTION: Application areas of computer graphics, overview of graphic system, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices.

UNIT-II

OUTPUT PRIMITIVES: Points and lines, line drawing algorithms, mid-point circle algorithm, Filled area primitives: scan-line polygon fill algorithm, boundary-fill and flood-fill algorithm.

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

UNIT -III

2-D VIEWING: The viewing pipe-line, viewing coordinate 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 -IV

3-D OBJECT REPRESENTATION: spline representation, Hermite curve,Bezier curve and B-spline curve, Polygon surfaces, quadric surfaces.

UNIT -V

3-D GEOMETRIC TRANSFORMATIONS: Translation, rotation, scaling,reflection and shear transformation and composite transformations. Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting.

UNIT-VI

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

TEXT BOOKS:

1. “Computer Graphics C version,” Donald Hearn and M. Pauline Baker, Pearson/PHI, 2nd edition, 2008.
2. “Computer Graphics Principles & practice,” Foley, VanDam, Feiner and Hughes, Pearson Education, second edition in C,1997.

REFERENCES:

1. "Computer Graphics Second edition", Zhigandxiang, Roy Plastock, Schaum's outlines, Tata Mc-Graw hill 1st edition, 2006.
2. "Procedural elements for Computer Graphics", David F Rogers, Tata Mc Graw hill, 2nd edition, 2011.
3. "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH, 1st edition, 1973.
4. "Computer Graphics", Steven Harrington, TMH, 2nd edition, 1983.

URLs:

1. http://nptel.ac.in/courses/106106090/(**Prof.SukhenduDas, IIT Madras**)

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III Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

ROBOTICS (16ME6E01)
(Common for ME, ECE, EEE, CSE and IT)

Course Objectives:

To make the students aware of:

1. *Robot applications, classifications, controlling systems and automation.*
2. *Robot components, their architecture, work envelope and types of drive systems.*
3. *Homogeneous transformations and Manipulator Kinematics of robots.*
4. *Robotic arm motion by using Mathematical approach.*
5. *Trajectory planning for a manipulator by avoiding obstacles and programming languages, software packages for path description to robots.*
6. *Functioning of sensors, actuators and Robot applications in manufacturing.*

UNIT – I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

UNIT – II

Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT – III

Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT – IV

Differential transformations and manipulators , Jacobians–problems. **Dynamics:** Lagrange – Euler and Newton – Euler formulations – Problems.

UNIT V

General considerations in path description and generation Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages-description of paths with a robot programming languages.

UNIT VI

Robot actuators and Feedback components:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.

REFERENCES:

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall.
3. Robot Analysis and Intelligence / Asada and Slow time / Wiley Inter-Science.
4. Introduction to Robotics / John J Craig / Pearson Edu.
5. http://www.nptel.ac.in/courses/112101099/1#

Course outcomes:

Students will be able to:

CO#	Statement	Cognitive Level
CO1	*classify the coordinate systems and control systems of a robot.*	
CO2	*explain the architecture of a robot.*	
CO3	*analyze kinematics of a serial manipulator.*	
CO4	*analyze dynamics of serial manipulator.*	
CO5	*develop the trajectory planning algorithms using programming languages.*	
CO6	*illustrate the applications of robots in manufacturing, select the actuators and feedback components for a given robot application.*	

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
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III Year –II Semester

L	T	P	C
4	**0**	**0**	**3**

GREEN ENGINEERING SYSTEMS (16CE6E04)
(OPEN ELECTIVE)

Course Objective:

To make the students aware of:

1. the fundamental knowledge of solar radiation and solar energy collectors.
2. the uses of solar energy and Wind Energy with respect to applications.
3. the sources of biomass, geothermal and ocean energy conversion systems and their principles.
4. electrical and mechanical energy efficient systems.
5. sustainable manufacturing processes.
6.
7. green buildings and Environmental friendly building materials.

Course Outcome:

Students will be able to:

CO#	Statement	Cognitive Level
CO1	Demonstrate the solar radiation and explain different solar energy collectors.	Understanding
CO2	Explain the use of solar energy and Wind Energy components used in the energy production with respect to applications.	Understanding
CO3	Compare the biomass, geothermal and ocean energy conversion systems and their principles.	Understanding
CO4	Illustrate the principles of electrical and mechanical energy efficient systems.	Understanding
CO5	Explain the concept of sustainable manufacturing processes.	Understanding
CO6	Explain the concept of green buildings and environmental friendly building materials.	Understanding

UNIT-I

INTRODUCTION:

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine,

solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – II

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT – III

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT –IV

ENERGY EFFICIENT SYSTEMS:

(A) ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

(B) MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps**.**

UNIT-V

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

UNIT – VI

GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

TEXT BOOKS:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/ TMH
2. Non-Conventional Energy Resources/ Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems, Edited / J. Paulo Davim/Springer 2013

REFERENCES:

1. Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S
1. Nanjunda Rao/New age international
2. Principles of Solar Engineering / D.Yogi Goswami, Frank Krieth & John F Kreider / Taylor & Francis
3. Non-Conventional Energy / Ashok V Desai /New Age International (P) Ltd
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa
5. Non conventional Energy Source/ G.D Roy/Standard Publishers
6. Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd
7. Fuel Cell Technology –Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd.

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III Year – II Semester

L	T	P	C
0	**0**	**3**	**2**

HEAT TRANSFER LAB (16ME6L09)

Course Objective:

The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.

LIST OF EXPERIMENTS

1. Determination of Overall heat transfer co-efficient Composite Slab Apparatus
2. Determination of Heat transfer through a lagged pipe.
3. Determination of Heat Transfer through a Concentric Sphere
4. Determination of Thermal Conductivity of given metal rod.
5. Determination of Heat transfer in pin-fin
6. Determination of Heat transfer in forced & natural convection apparatus.
7. Determination of Parallel and counter flow heat exchanger.
8. Determination of Emissivity of a given surface .
9. Determination of Stefan Boltzmann constant.
10. Determination of Heat transfer in drop and film wise condensation.
11. Determination of Critical Heat flux.
12. Study of heat pipe and its demonstration.
13. COP of VCR System with Capillary and thermal expansion valve.
14. Determination of thermal conductivity of liquids and gases.

Note: *Any 10 experiments are to be conducted among 14*

Course Outcome:

The student should be able to evaluate the amount of heat exchange for plane, cylindrical & spherical geometries and should be able to compare the performance of extended surfaces and heat exchangers

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III Year – II Semester

L	T	P	C
0	**0**	**3**	**2**

METROLOGY & INSTRUMENTATION LAB (16ME6L10)

METROLOGY LAB:

Course Objective:

The Metrology and instrumentation Laboratory course is designed for measuring and gauging instruments for inspection of precision linear, geometric forms, angular and surface finish measurements. The student can learn the measurements with and calibration of instruments. They also understand the machine tool alignment test.

LIST OF EXPERIMENTS

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers, slip gauges etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier caliper for tooth thickness inspection and flange micro meter for checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.
5. Machine tool alignment test on drilling machine.
6. Machine tool alignment test on milling machine.
7. Angle and taper measurements with bevel protractor, Sine bars, rollers and balls.
8. Use of spirit level in finding the straightness of a bed and flatness of a surface.
9. Thread inspection with two wire/ three wire method & tool makers microscope.
10. Surface roughness measurement with roughness measuring instrument.

Note: *Any 6 experiments are to be conducted among 10*

Course outcomes:

Student will become familiar with the different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc).

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INSTRUMENTATION LAB

***Course Objective**:*

Instrumentation lab introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various instruments for measuring pressure, temperature, displacement, speed, vibration etc.

LIST OF EXPERIMENTS

1. Calibration of pressure gauge.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge.
5. Calibration of thermocouple.
6. Calibration of capacitive transducer.
7. Study and calibration of photo and magnetic speed pickups.
8. Calibration of resistance temperature detector.
9. Study and calibration of a rotameter.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.

***Note:** Any 6 experiments are to be conducted among 11*

Course outcome:

Students will be able to select proper measuring instrument and know requirement of calibration, errors in measurement etc. They can perform accurate measurements.

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III Year – II Semester	**L**	**T**	**P**	**C**
	0	**3**	**0**	**0**

PROFESSIONAL ETHICS AND HUMAN VALUES (16BH6T17)

UNIT-I

Professional Ethics and Human values: Ethics -History of Ethics-Types of Ethics, Professional Ethics and its forms -Significance-Personal ethics vs Professional Ethics, Morals, Values – Integrity – Work Place Ethics and Business Ethics –Ethics in HRM, Finance, Marketing Management – Civic Virtue –Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value time –Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

UNIT-II

Engineering Ethics: Engineering Ethics-Meaning & Purpose of Engineering Ethics- Consensus and Controversy –Profession, Professional and Professionalism –Key Characteristics of Engineering Professionals – Professional Roles to be played by an Engineer-Self Interest, Customs and Religion- Ethical Theories-Meaning & Uses of Ethical Theories-Types of Inquiry - Theories of moral Development-Kohlberg's Theory – Gilligan's Argument –Heinz's Dilemma.

UNIT-III

Engineering as Social Experimentation: Comparison with Standard Experiments – Knowledge gained – Conscientiousness – Relevant Information – Learning from the Past – Engineers as Managers, Consultants, and Leaders – Accountability – Role of Codes – Codes and Experimental Nature of Engineering- Ethical issues involved in Clinical Trials.

UNIT-IV

Engineers' Responsibility for Safety and Risk: Concept of Safety-Types of Safety, Risk-Types of Risks, Voluntary v/s Involuntary Risk- Short term v/s Long term Consequences- Expected Probability- Reversible Effects- Threshold Levels for Risk- Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT-V

Engineers Responsibilities and Rights: Collegiality-Techniques for Achieving Collegiality – Loyalty -Two Senses of Loyalty-obligations of Loyalty-Misguided Loyalty – professionalism and Loyalty- Professional Rights –Professional Responsibilities – confidential and proprietary information-Conflict of Interest-solving conflict problems - Ethical egoism-Collective bargaining-Confidentiality-Acceptance of Bribes/Gifts when is a Gift and a Bribe-examples of Gifts v/s Bribes-problem solving-interests in other companies-Occupational Crimes-industrial espionage-price fixing-endangering lives- Whistle Blowing-types of whistle blowing-when should it be attempted-preventing whistle blowing.

UNIT-VI

Global Issues: Globalization-Problems of globalization- Cross-culture Issues-Environmental Ethics-Computer Ethics-computers as the instrument of Unethical behavior-computers as the object of Unethical Acts-autonomous computers-computer codes of Ethics-Weapons Development-Ethics and Research-Analyzing Ethical Problems in Research-Food and Drug Adulteration.

Relevant case studies shall be dealt where ever necessary.

Reference Books:

1. "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
2. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana- Maruthi Publications.
3. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications
4. "Professional Ethics and Human Values" by Prof.D.R.Kiran-
5. "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication
6. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger -Tata McGraw- Hill -2003
7. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

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IV Year – I Semester

L	T	P	C
4	**0**	**0**	**3**

MECHATRONICS (16ME7T25)

Course Objective:

To give the clear idea about:

1. *Frame of reference on mechatronic systems and their response.*
2. *Functioning of solid state electronic devices.*
3. *Overview of various actuating systems.*
4. *Programming of microprocessors and microcontrollers in various fields.*
5. *Overview of interfacing the system, data acquisition and signal conditioning in manipulation of analog signals.*
6. *Emphasis of process controllers.*

UNIT-I

Mechatronics systems – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Solid state electronic devices – PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering.

UNIT-III

Hydraulic and pneumatic actuating systems – Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro- pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

UNIT-IV

Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V

System interfacing and data acquisition – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, block diagrams, typical layouts, Interfacing motor drives.

UNIT -VI

Dynamic models and analogies, System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trends.

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP
2. Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition.

REFERENCES:

1. Mechatronics – Smaili A, Mrad F, Oxford Higher Education, Oxford University Press.
2. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
3. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
4. Mechatronics System Design / Devdas shetty/Richard/Thomson.
5. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
6. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. by W. Bolton, 4th Edition, Pearson, 2012
7. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, Indian print.

Course outcomes:

Student will be able to:

CO#	Statement	Cognitive Level
CO1	*Demonstrate the mechatronic systems in various industrial fields.*	
CO2	*Functioning of solid state electronic devices.*	
CO3	*Experiment with hydraulic and pneumatic actuating systems.*	
CO4	*Measure physical quantities using digital electronics and systems.*	
CO5	*Create system interfacing and data acquisition*	
CO6	*Design dynamic models using various responses*	

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L	T	P	C
4	**0**	**0**	**3**

CAD/CAM (16ME7T26)

Course Objectives:

Enable the students to

1. *Understand the basic fundamentals of computer aided design and manufacturing.*
2. *Apply the basic knowledge of the different geometric modeling techniques.*
3. *Understand concepts of part programming for NC.*
4. *Demonstrate about GT, CAPP and FMS.*
5. *Learn computer aided quality control and CAT.*
6. *Learn Manufacturing systems, material handling systems and computer control systems.*

UNIT – I

Fundamentals of CAD: Computers In Industrial Manufacturing, Product Cycle, CAD / CAM Hardware, Basic Structure, CPU, Memory Types, Input Devices, Display Devices, Hard Copy Devices, Storage Devices.

Computer Graphics: Raster Scan Graphics Coordinate System, Database Structure For Graphics Modeling, Transformation Of Geometry, 3D Transformations, Mathematics Of Projections, Clipping, Hidden Surface Removal.

UNIT – II

Geometric Modeling: Requirements, geometric models, geometric construction models, Curve representation methods, surface representation methods, modeling facilities desired. Solid modeling - solid representation, boundary representation and constructive solid geometry.

Drafting: Basic geometric commands, layers, display control commands, editing, dimensioning.

UNIT – III

Part Programming for NC Machines: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

UNIT – IV

Group Technology: Part family, coding and classification, production flow analysis, types and advantages.

Computer aided processes planning (CAPP) – importance, types-Retrieval type CAPP system, Generative type CAPP system and Hybrid CAPP System, benefits of CAPP. FMS – Introduction, Equipment, Tool Management Systems, Layouts, FMS control.

UNIT – V

Computer Aided Quality Control: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, Computer Aided Testing (CAT), integration of CAQC with CAD/CAM.

UNIT – VI

Computer Integrated Manufacturing Systems: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.

TEXT BOOKS:

1. CAD / CAM / CAE E Zimmers & M.Groover/Pearson Education
2. Automation, Production systems & Computer integrated Manufacturing/ Groover/P.E
3. Principles and applications of CAD/CAM by J.Srinivas, Oxford University Press, N.D, 2017.

REFERENCES:

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH.
2. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson.
3. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.
4. Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang, Elsevier Publishers.
5. CAD/CAM/CIM by P. Radhakrishnan, S.Subramanyan, V.Raju, New age Publications.
6. http://nptel.ac.in/courses/112102101/

Course Outcomes:

Students shall be able to:

CO#	Statement	Cognitive Level
CO1	*Explain the fundamentals of CAD and outline the basic entities.*	
CO2	*Demonstrate the geometric modeling techniques.*	
CO3	*Develop part programming for NC machines.*	
CO4	*Explain about group technology and computer aided process planning.*	
CO5	*Illustrate quality control using computers.*	
CO6	*Classify manufacturing system integrated with computers.*	

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4	**0**	**0**	**3**

FINITE ELEMENT METHODS (16ME7T27)

Course Objectives:

Students will learn:

1. *The basic principles of finite element analysis procedure.*
2. *Concept of discretization and characteristics of finite elements that represent engineering structures.*
3. *The analysis of trusses and beams.*
4. *Analysis of 2-D problems.*
5. *The use of higher order elements for 1-D and 2-D problems.*
6. *To solve heat transfer and other field problems using FEM and FE procedure for dynamic analysis of structures.*

UNIT-I

Introduction to finite element method- basic concepts, historical back ground, applications of FEM, general description. Comparison of FEM with other methods, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, and one dimensional problems.

UNIT – II

Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – III

Analysis of Trusses: Finite element modeling coordinates and shapes functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress and strain and support reaction calculations. Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – IV

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axi-symmetric problems.

UNIT-V

Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

UNIT – VI

Steady state heat transfer analysis: one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu / Prentice – Hall.
2. The Finite Element Methods in Engineering / SS Rao / Pergamon.

REFERENCES:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers.
2. An introduction to Finite Element Method / JN Reddy / McGrawHill.
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
4. Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson Education.
5. http://en.wikipedia.org/wiki/Finite_element_method
6. http://reference.wolfram.com/applications/structural/FiniteElementMethod.html
7. http://www.finite-element-method.info/
8. http://nptel.iitm.ac.in/video.php?courseId=1012

Course outcomes:

Student will be able to:

CO#	Statement	Cognitive Level
CO1	*demonstrate the variational methods and weighted residual methods for solution to engineering problems.*	
CO2	*Explain the various steps in the procedure for FEM.*	
CO3	*Solve the one dimensional problems like trusses and beams by FEM*	
CO4	*Solve the 2-D problems using CST and axi-symmetric elements.*	
CO5	*Solve the 1-D and 2-D using higher order elements.*	
CO6	*Solve the heat transfer , torsional and free vibration problems*	

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L	T	P	C
4	**0**	**0**	**3**

POWER PLANT ENGINEERING (16ME7T28)

Course Objectives:

This course imparts the concepts of

1. *Power generation through different prime movers by using steam.*
2. *Power generation through prime movers by using Diesel and Gas.*
3. *Power generation through prime movers by using hydraulic energy and its classifications.*
4. *Power generation through Nuclear Reactors.*
5. *Combined operations, instrumentation and coordination of different types of power plants.*
6. *Importance of economic and environmental considerations of power plants.*

UNIT – I

Introduction to the sources of energy – resources and development of power in india.

STEAM POWER PLANT: Plant layout, working of different circuits, fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems. Combustion: 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 AND GAS TURBINE POWER PLANTS:

DIESEL POWER PLANT: Plant layout with auxiliaries – fuel supply system, air starting equipment, super charging.

GAS TURBINE PLANT: Introduction – layout with auxiliaries, 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.

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

COMBINED OPERATIONS OF DIFFERENT POWER PLANTS:

Introduction, advantages of combined working, load division between power stations, storage type hydro-electric plant in combination with steam plant, run-of-river plant in combination with steam plant, pump storage plant in combination with steam or nuclear power plant, co-ordination of hydro-electric and gas turbine stations, co-ordination of hydro-electric and nuclear power stations, co-ordination of different types of power plants.

POWER PLANT INSTRUMENTATION AND CONTROL: Importance of measurement and instrumentation in power plant, measurement of water purity, Exhaust gas analyzer, O_2 and CO_2 measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

UNIT – VI

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.

TEXT BOOKS:

1. A course in Power Plant Engineering – Arora and Domkundwar, Dhanpatrai & Co.
2. Power Plant Engineering: P.K.Nag/ II Edition /TMH.

REFERENCES:

1. Power station Engineering – ElWakil / McHill.
2. Power Plant Engineering – P.C.Sharma / S.K.Kataria Pub
3. An Introduction to Power Plant Technology / G.D. Rai.

Course outcomes:

Student will be able to:

CO#	Statement	Cognitive Level
CO1	*Explain the concepts of power generation through prime movers from steam.*	
CO2	*Classify the power plants and illustrate the construction.*	
CO3	*Illustrate different power plants (conventional) for generation of power.*	
CO4	*Classify different reactors for power generation*	
CO5	*Illustrate various instrumentation and operations related to power plants.*	
CO6	*Estimate various costs related to the economics of power plants.*	

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4	**0**	**0**	**3**

COMPUTATIONAL FLUID DYNAMICS (16ME7D01)
(ELECTIVE – I)

Course Objectives:

1. *To learn fundamentals of numerical techniques and error estimation using computational methods.*
2. *To learn the different methods to solve the system of simultaneous equations.*
3. *To solve the conduction and convection heat transfer problems using finite difference methods.*
4. *To learn the application of finite difference method to fluid flow problems.*
5. *To learn the modeling of fluid flow.*
6. *To learn finite volume method using various interpolations.*

UNIT-I

ELEMENTARY DETAILS IN NUMERICAL TECHNIQUES: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.

UNIT-II

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 banded matrices.

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, and special forms of the navier-stokes equations.

UNIT-III

Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function - vorticity formulation. 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, closure.

UNIT-IV

Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modelling: introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT-V

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the upwind scheme.

UNIT-VI

FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar/Butter-worth Publishers
2. Computational fluid dynamics - Basics with applications /John. D. Anderson / Mc Graw Hill.

REFERENCES:

1. Computational Fluid Flow and Heat Transfer/ Niyogi/Pearson Publications
2. Fundamentals of Computational Fluid Dynamics /Tapan K. Sengupta / Universities Press.
3. Computational fluid dynamics: An introduction, 3rd edition/John.F Wendt/Springer publish

Course Outcome:

Student will be able to:

CO#	Statement	Cognitive Level
CO1	*Interpret the effect number systems and its representation in error estimation.*	
CO2	*Demonstrate the different computational methods for solution to system of simultaneous equations.*	
CO3	*Recall the governing differential equations for fluid flow and heat transfer..*	
CO4	*Explain the application of finite difference method to the solution of heat transfer..*	
CO5	*Explain the modeling of fluid flow.*	
CO6	*Explain the different interpolations and differentiation techniques in finite volume method.*	

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L	T	P	C
4	**0**	**0**	**3**

CONDITION MONITORING (16ME7D02)
(ELECTIVE I)

Course Objective:

The students will learn:

1. *Basics of Vibration in conditional monitoring.*
2. *Techniques of vibration measurement and analysis.*
3. *Fault diagnosis and some case studies for interpreting vibration measurement.*
4. *Thermography and its applications in conditional monitoring*
5. *Oil and wear debris analysis and its properties.*
6. *Ultrasonic monitoring and analysis and study requirements.*

UNIT – I

BASICS OF VIBRATION: Basic motion: amplitudes, period, frequency, basic parameters: displacement, velocity, acceleration, units (including dB scales) and conversions, Mass, spring and damper concept, Introduction to SDOF and MDOF systems, Natural frequencies and resonance, Forced response.

UNIT – II

VIBRATION MEASUREMENTS AND ANALYSIS: Transducers and mounting methods, data acquisition using instrumentation recorders/data loggers, time domain signal analysis, orbit analysis, Filters, Frequency domain analysis (Narrow band FFT analysis), Nyquist criteria, Sampling, aliasing, windowing and averaging.

VIBRATION MEASUREMENT AND ANALYSIS: Use of phase; bode, polar and water fall plots, constant percentage band width analysis (1/3 and 1/1 Octave analysis), envelope detection /spike energy analysis, cepstral analysis, advances in analysis (PC based and portable instruments for vibration analysis).

UNIT – III

Fault Diagnosis, Interpreting vibration measurements for common machine faults , imbalance, misalignment, mechanical looseness, bearing and gearing faults, faults in induction motors, resonances, some case studies, static and dynamic balancing, international standards for vibration condition monitoring.

UNIT – IV

THERMOGRAPHY: The basics of infrared thermography, differences in equipment and specific wave length limitations, application of ir to: electrical inspection, mechanical inspection, energy conservation, how to take good thermal images, hands-on demonstrations focusing on proper camera settings and image interpretation, analysis of thermal images and report generation, study of thermo graphy applications

UNIT – V

OIL AND WEAR DEBRIS ANALYSIS: Basics of oil analysis, monitoring condition of oil, lubricant analysis, physio – chemical properties, moisture, tan tbn, wear debris analysis, particle counting, spectroscopy, uses & limitations, ferrography wear particle analysis, concept of ferrography, principle particle classification, size, shape, composition, concentration, analysis procedure, sampling & analytical ferrography equipments, severity rating.

UNIT – VI

ULTRASONIC MONITORING AND ANALYSIS: Ultrasonic monitoring (leak, crack and thickness) basics of ultrasonic monitoring , ultrasonic theory, test taking philosophy, ultrasonic theory, mathematics of ultrasound, equipment and transducers, inspection parameters and calibration, immersion theory, equipment quality control, flaw origins and inspection methods, UT Procedure familiarization, and study recommendations, application of ultrasound to: air leaks, steam trap testing, bearing lubrication, electrical inspection, case studies.

TEXT BOOKS:

1. The Vibration Analysis Handbook, J I Taylor (1994)
2. Machinery Vibration Condition Monitoring, Lynn, Butterworth(1989)

REFERENCES:

1. Machinery Vibration: Measurement and Analysis. Victor Wowk (1991).
2. Mechanical fault diagnosis and condition monitoring, RA Collacott (1977).
3. The Vibration Monitoring Handbook (Coxmoor's Machine & Systems Condition Monitoring) (1998).
4. Condition monitoring of machinery by J.S.Rao, Narosa publishers,2013
5. http://nptel.ac.in/courses/112103112/40

Course Outcomes:

Student will be able to

CO#	Statement	Cognitive Level
CO1	*Explain the concepts of Vibration, SDOF and MDOF systems.*	
CO2	*Analyze the vibrations using various techniques*	
CO3	*Interpret various faults in vibrations for diagnosis*	
CO4	*Inspect the equipments using thermography*	
CO5	*Analyze various properties of oil and wear particles by condition monitoring.*	
CO6	*Examine the ultrasonic monitoring by testing and inspection.*	

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L	T	P	C
4	**0**	**0**	**3**

ADDITIVE MANUFACTURING (16ME7D03)
(ELECTIVE I)

Course Objective:

Students will learn

1. *Additive manufacturing Technology in product development*
2. *Concepts of solid-based rapid prototyping systems.*
3. *Powder based additive manufacturing systems and 3D printing.*
4. *Concepts of rapid and conventional tooling.*
5. *Rapid prototyping data formats and features RP software's.*
6. *Applications of additive manufacturing in various industries.*

UNIT – I

INTRODUCTION: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

LIQUID-BASED RAPID PROTOTYPING SYSTEMS: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – II

SOLID-BASED RAPID PROTOTYPING SYSTEMS: Laminated object manufacturing (LOM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modelling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – III

POWDER BASED RAPID PROTOTYPING SYSTEMS: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – IV

RAPID TOOLING: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting, 3D Keltool process. Direct rapid tooling: direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

UNIT – V

RAPID PROTOTYPING DATA FORMATS: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file Repairs: Generic Solution, other Translators, Newly Proposed Formats.

RAPID PROTOTYPING SOFTWARE'S: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT – VI

RP APPLICATIONS: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis, design and production of medical devices, forensic science and anthropology, visualization of bimolecular.

TEXT BOOKS:

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.
2. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.
3. G Odian , Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4th edition, 2005

REFERENCES :

1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2007.
2. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006. 3. Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2000.
3. V.R. Gowarikar, Polymer Science, , New Age Int., 2002
4. F.W. Billmeyer Jr , Text book of Polymer Science, Inter science Publisher John Wiley and Sons, 3rd edition 1999.
5. nptel.ac.in/courses/112104204/47
6. nptel.ac.in/courses/112107078/37
7. nptel.ac.in/syllabus/112104156/

Course Outcomes:

Student will be able to:

CO#	Statement	Cognitive Level
CO1	*Explain the importance of additive manufacturing in industrial growth.*	
CO2	*develop the CAD models and make use of software for additive manufacturing*	
CO3	*Compare liquid and solid based additive Manufacturing systems.*	
CO4	*Inspect powder based additive manufacturing systems such as 3D printing, laser engineering net shaping and Electron Beam Melting.*	
CO5	*Illustrate polymerization process, polymer processing and the significance for additive manufacturing.*	
CO6	*Elaborate the use of medical and bio-additive manufacturing and other the industrial applications.*	

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4	**0**	**0**	**3**

ADVANCED MATERIALS (16ME7D04)
(ELECTIVE-II)

Course Objective:

The objective of this course is to give:

1. *Basic understanding of composite materials and reinforcements.*
2. *Detail explanation of different polymer composites and their applications*
3. *Knowledge on manufacturing methods of composite materials.*
4. *Detail explanation on laminates and its macro-mechanical analysis.*
5. *Knowledge on FGM and shape memory alloys.*
6. *Basic understanding of Nano materials and their applications.*

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 born carbide fibres.

UNIT-II

Polymer composites, thermoplastics, thermosetting plastics, manufacturing of PMC, MMC & CCC and their applications.

UNIT –III

MANUFACTURING METHODS: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

UNIT –IV

MACROMECHANICAL ANALYSIS OF A LAMINA: Introduction, generalized Hooke's law, reduction of Hooke's law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of an orthotropic lamina, laminate-laminate code.

UNIT –V

FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-classification-different systems-preparation-properties and applications of functionally graded materials.

SHAPE MEMORY ALLOYS: Introduction-shape memory effect classification of shape memory alloys-composition-properties and applications of shape memory alloys.

UNIT-VI

NANO MATERIALS: Introduction-properties at nano scales-advantages & disadvantages-applications in comparison with bulk materials (nano – structure, wires, tubes, composites). State of art nano advanced –topic delivered by student.

TEXT BOOKS:

1. Nano material by A.K. Bandyopadyay, New age Publishers.
2. Materials Science and Engineering: An Introduction - William D Callister Jr
3. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press.

REFERENCES :

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold.
3. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.
4. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), Autar K.Kaw, Publisher: CRC.
5. **http://nptel.ac.in/courses/113105057/2**
6. **http://www.nptelvideos.in/2012/12/advanced-materials-and-processes.html**

Course Outcomes:

Student will be able to:

CO#	Statement	Cognitive Level
CO1	*Explain the fundamentals of different composite materials.*	
CO2	*Classify different composite materials with their applications.*	
CO3	*Illustrate various manufacturing methods of composite materials.*	
CO4	*Analyze macro-mechanical structure of a lamina.*	
CO5	*Classify functionally graded materials and shape memory alloys.*	
CO6	*Illustrate Nano materials and their applications.*	

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L	T	P	C
4	**0**	**0**	**3**

DESIGN FOR MANUFACTURE (16ME7D05)
(ELECTIVE-II)

Course Objectives:

Students will learn:

1. *Various steps in design processes and various effects on manufacturing processes.*
2. *Rules in design processes and general recommendations for design of machine parts.*
3. *Different Metal casting processes and general considerations for design of machine parts and assembly.*
4. *Types of Metal joining processes and general guidelines for design of machining processes.*
5. *Types of Metal forming processes and general guidelines for design of machining processes.*
6. *Various non metallic joining &forming processes and general guidelines for manufacturing processes.*

UNIT– I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design. Design for the life cycle total product life consumer goods –design considerations. Effect of manufacturing process on design, mechanisms selection, evaluation method.

UNIT- II

Machining processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining-ease-redesigning of components for machining ease with suitable examples. General design recommendations for machined parts. Design for economy - Design for accessibility.

UNIT- III

Metal casting: Appraisal of various casting processes, selection of casting process, -general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting. Design for assembly method- Dewhurst DFA method.

UNIT-IV

Metal joining: Appraisal of various welding processes factors in design of weldments– general design guidelines-pre and post treatment of welds- effects of thermal stresses in weld joints-design of brazed joints.

Forging: Design factors for forging– closed die forging design– parting lines of dies– drop forging die design– general design recommendations.

UNIT–V

Extrusion & Sheet metal work: Design guide lines extruded sections- design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram– component design for blanking.

UNIT–VI

Non Metallic Components Design : Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding–design guidelines for machining and joining of plastics. Blow moulded, welded plastic articles, ceramics.

TEXTBOOKS:

1. Design for Manufacture by Boothroyd Dewhurst
2. Design for manufacture, Johncobert,AdissonWesley1995
3. Design for manufacture, James Bralla

REFERENCS:

1. ASM HandbookVol.20
2. http://nptel.ac.in/syllabus/112101005/
3. http://nptel.ac.in/syllabus/syllabus_pdf/112101005.pdf
4. http://nptel.ac.in/courses/107103012/6
5. http://nptel.ac.in/courses/112101005/

Course outcomes:

Students will be able to:

CO#	Statement	Cognitive Level
CO1	*Illustrate design processes and effects on manufacturing process.*	
CO2	*Design various components for machining*	
CO3	*Demonstrate metal casting*	
CO4	*Summarize welding processes considering real time factors.*	
CO5	*Develop sheet metal work and extrusion*	
CO6	*Design non metallic component using plastics*	

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IV Year – I Semester

L	T	P	C
4	**0**	**0**	**3**

GAS DYNAMICS AND JET PROPULSION (16ME7D06)
(ELECTIVE-II)

Course Objectives:

Students will learn:

1. *Basic concept of gas dynamics.*
2. *The Isentropic flow fundamentals.*
3. *The compressible flow with friction and heat transfer*
4. *The application of normal shock in compressible flow.*
5. *The thrust equation and its usage in jet aircraft.*
6. *The aircraft propulsion systems and rocket propulsion and its applications.*

UNIT-I

Introduction to gas dynamics: control volume and system approaches acoustic waves and sonic velocity - Mach number - classification of fluid flow based on mach number - mach cone-compressibility factor - general features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume.

UNIT-II

Isentropic flow of an ideal gas: basic equation - stagnation enthalpy, temperature, pressure and density-stagnation, acoustic speed - critical speed of sound- dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function. Steady one dimensional isentropic flow with area change-effect of area change on flow parameters- chocking- convergent nozzle - performance of a nozzle under decreasing back pressure -De lavel nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies.

UNIT- III

Simple frictional flow: adiabatic flow with friction in a constant area duct governing equations - fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct governing equations - limiting conditions.

Steady one dimensional flow with heat transfer in constant area ducts governing equations - Rayleigh line entropy change caused by heat transfer - conditions of maximum enthalpy and entropy.

UNIT-IV

Effect of heat transfer on flow parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gas- properties of flow across a normal shock - governing equations - Rankine Hugoniat equations - Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - shock strength.

UNIT- V

Propulsion: Air craft propulsion: - types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems.

UNIT-VI

Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines. Rocket propulsion - rocket engines, Basic theory of equations - thrust equation - effective jet velocity - specific impulse - rocket engine performance - solid and liquid propellant rockets - comparision of various propulsion systems.

TEXT BOOKS:

1. Fundamentals of compressible flow with aircraft and rocket propulsion- S. M. Yahya
2. Compressible fluid flow - A. H. Shapiro.
3. Fundamental of Gas dynamics, 2nd edition– Zucker- Wiley publishers.

Data book :Compressible flow gas tables S. M. Yahya ,New age international publications.

REFERENCES:

1. Elements of gas dynamics - Liepman & Roshko.
2. Aircraft & Missile propulsion - Zucrow.
3. Gas dynamics - M.J. Zucrow & Joe D.Holfman.

1. https://youtu.be/_6796gj7-Gw
2. https://youtu.be/lnViENuD8Ek
3. https://youtu.be/lRS4EiNaTwg
4. https://youtu.be/nw2rWNNmtl0
5. https://youtu.be/i-7IivttOjY
6. https://youtu.be/vKY9KJuFX9o

Course Outcomes:

Student will be able to:

CO#	Statement	Cognitive Level
CO1	*Explain basic concepts of gas dynamics.*	
CO2	*Analyze the steady one-dimensional isentropic flow.*	
CO3	*Interpret the flow properties in an isothermal flow with friction.*	
CO4	*Inspect the effect of heat transfer on flow parameters.*	
CO5	*Illustrate propulsion in various aircrafts.*	
CO6	*Evaluate the performance of rockets.*	

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(Autonomous)

IV Year – I Semester

L	T	P	C
0	**0**	**3**	**2**

CAD/CFD LAB (16ME7L11)

Course Objectives:

To impart knowledge on how to prepare drawings for various mechanical components using any commercially available 3D modeling software's and various Finite Element Analysis tools.

CAD LAB

1. DRAFTING: Development of part drawings for various components in the form of orthographic and isometric representation of dimensioning and tolerances scanning and plotting. Study of script, DXE and IGES files.
2. PART MODELING: Generation of various 3D models through protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and assembly modeling. Study of various standard translators. Design simple components. Generative drafting exercises.
3. Import CAD model into analysis software and carry out the following:
   a) Determination of deflection and stresses in 2D and 3D trusses and beams.
   b) Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.
   c) Determination of stresses in 3D and shell structures (at least one example in each case).
   d) Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
   e) Steady state heat transfer Analysis of plane and Axisymmetric components

Packages to be provided to cater to drafting, modeling & analysis from the following:
Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA,CAEFEM, ABACUS etc.

Total 6 experiments to be conducted from the above mentioned 3 experiments.

Course Outcomes:

Student will be able to acquire knowledge on utilizing these tools for a better project in their curriculum as well as they will be prepared to handle industry problems with confidence when it matters to use these tools in their employment.

CFD LAB

Course Objectives:

- *Solving Problems of fluid mechanics and heat transfer by writing programs in C-language and MATLAB.*
- *Using ANSYS-FLUENT build geometry, mesh that geometry, Perform CFD method on the mesh, perform the calculation, and post-process the results.*

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PART-A

Writing Programs in C and MATLAB for the following:

1. Solution of Transcendental equations.
2. Solution of Simultaneous algebraic equations
3. Numerical differentiation and Integration
4. Solution of Ordinary Differential Equation
5. Solution of a Tri-diagonal matrix using Thomas Algorithm.
6. Solution of Partial differential equations related to
    i. Elliptical Partial differential equations
    ii. Parabolic Partial differential equations
    iii. Hyperbolic Partial differential equations
7. Solution of 1-D and 2-D heat conduction with (Finite Difference method)
    i. Constant temperature boundary conditions
    ii. Constant heat flux boundary conditions
    iii. Convective boundary conditions
8. Solution of Incompressible Navier-Stokes equations (Finite difference and Finite Volume methods)
9. Solution of Inviscid incompressible fluid flows.(Finite difference and Finite Volume methods)

PART-B

Using ANSYS-FLUENT solve the following problems of heat transfer analysis

1. Steady state conduction
2. Lumped heat transfer
3. Convective heat transfer – Internal flow (study both velocity and thermal boundary layers)
4. Convective heat transfer – External flow (study both velocity and thermal boundary layers)
5. Radiation heat transfer– Emissivity

Total 6 experiments to be conducted from any 3 experiments at each part.

Course outcome:

The student will be able to appreciate the utility of the tools like ANSYS- FLUENT in solving real time problems and day to day problems.

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IV Year – I Semester

L	T	P	C
0	**0**	**3**	**2**

CAM / MECHATRONICS LABORATORY (16ME7L12)

CAM LAB

Course Objectives:

To impart knowledge on G-codes and M-codes for CNC programming and to know various tools to be used to improve the product in industries.

LIST OF EXPERIMENTS:

1. Study of various post processors used in NC Machines.
2. Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package.
3. CNC part programming Entry and Geometry.
4. Practices on CNC Turning
   a) Programming for facing operation.
   b) Programming for Turning operation.
   c) Programming for Linear and Circular interpolation.
   d) Programming for Facing Cycle.
   e) Programming for Multiple Facing Cycle.
   f) Programming for Grooving Cycle.
5. Practice on CNC Milling
   a) Programming using linear and circular interpolation.
   b) Programming using Sub-Program.
   c) Programming for Mirroring Operation.
   d) Programming for Circular Pocket Milling operation.
   e) Programming for Rectangular Pocket milling operation.
   f) Programming for Drilling Operation.
6. Automated CNC Tool path & G-Code generation using Pro/E/Master CAM

Software's to be used: Micro Station,Gibbs CAM, Master CAM etc.

Course Outcomes:

The student will be able to appreciate the utility of the tools like Gibbs CAM, Master CAM in real time applications.

MECHATRONICS LAB

Course Objectives:

To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic systems which enable the students to understand the concept of mechatronics.

List of Experiments:

1. PLC PROGRAMMING

a. Ladder programming on Logic gates ,Timers & counters
b. Ladder Programming for digital & Analogy sensors
c. Ladder programming for Traffic Light control, Water level control and Lift control Modules

2. AUTOMATION STUDIO software

a. Introduction to Automation studio & its control
b. Draw & Simulate the Hydraulic circuit for series & parallel cylinders connection
c. Draw & Simulate Meter-in, Meter-out and hydraulic press and clamping.

3. MATLAB Programming

a. Sample programmes on Matlab/SIMULINK
b. Simulation and analysis of PID controller using SIMULINK

Course Outcomes:

The student will be able to:

CO#	Statement	Cognitive Level
CO1	*Measure load, displacement and temperature using analogue and digital sensors.*	
CO2	*Develop PLC programs for control of traffic lights, water level, lifts and conveyor belts.*	
CO3	*Simulate and analyze PID controllers for a physical system using MATLAB.*	
CO4	*Develop pneumatic and hydraulic circuits using Automaton studio.*	

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IV Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

PRODUCTION PLANNING AND CONTROL (16ME8T29)

Course objectives:

Students will learn:

1. *The concept of production and service systems.*
2. *General principle techniques and types of forecasting.*
3. *Concept of inventory management.*
4. *Principles of routing and factors effecting routing.*
5. *Different methods of scheduling and controlling aspects.*
6. *Dispatching procedures and role of computer in production planning and control.*

UNIT – I

Introduction: Definition – objectives and functions of production planning and control – elements of production control – types of production – organization of production planning and control department – internal organization of department.

UNIT-II

Forecasting – importance of forecasting – types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitative methods.

UNIT – III

Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems. Introduction to MRP I, MRP II, ERP, LOB (Line of Balance), JIT and KANBAN system**.**

UNIT – IV

Routing – definition – routing procedure –route sheets – bill of material – factors affecting routing procedure, schedule –definition – difference with loading.

UNIT – V

Scheduling policies – techniques, standard scheduling methods. Line Balancing, aggregate planning, chase planning, expediting, controlling aspects.

UNIT – VI

Dispatching – activities of dispatcher – dispatching procedure – follow up – definition – reason for existence of functions – types of follow up, applications of computer in production planning and control.

TEXT BOOKS:

1. Elements of Production Planning and Control / Samuel Eilon.
2. Manufacturing, Planning and Control, Partik Jonsson Stig-Arne Mattsson, Tata Mc Graw Hill.

REFERENCES:

1. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
2. Production Planning and Control, Mukhopadyay, PHI.
3. Production Control A Quantitative Approach / John E. Biegel.
4. Production Control / Moore.
5. https://youtu.be/yYIVumq6sVM
6. https://youtu.be/DVEbZ__FNRg
7. https://youtu.be/k9dhcfIyOFc
8. https://youtu.be/zlZaOnBbpUg
9. https://youtu.be/Aw77aMLj9uM
10. https://youtu.be/4oMmzCESLlY

Course Outcomes:

Students will be able to:

CO#	Statement	Cognitive Level
CO1	*Demonstrate various production and service systems.*	
CO2	*Summarize the concept of forecasting and their techniques.*	
CO3	*Recall the inventory management.*	
CO4	*Utilize routing procedure bill of material and scheduling processes*	
CO5	*Apply different scheduling and balancing techniques.*	
CO6	*Explain dispatching procedure and role of computer in production planning and control.*	

1.

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IV Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

UNCONVENTIONAL MACHINING PROCESSES (16ME8T30)

Course Objective:
Students will learn

1. The classification of unconventional machining processes.
2. *Mechanism of electro-chemical machining and different types of electro-chemical machining processes.*
3. *Different machining processes based of thermal energy, he will also able to estimate the material removal rate.*
4. *Laser Beam machining and its applications.*
5. *Plasma machining process.*
6. *Abrasive and water jet machining processes*.

UNIT – I

INTRODUCTION: Need for non-traditional machining methods-classification of modern machining process – considerations in process selection, applications. **Ultrasonic machining** – Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

UNIT – II

ELECTRO – CHEMICAL MACHINING: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and de-burring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate, fundamentals of chemical machining, advantages and applications.

UNIT – III

THERMAL METAL REMOVAL PROCESSES: General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface

UNIT – IV

Electron Beam Machining, Laser Beam Machining - Basic principle and theory, mechanics of material removal, process parameters, efficiency & accuracy, applications

UNIT-V

Plasma Machining: Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

UNIT – VI

Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanics of material removal, MRR, application and limitations, magnetic abrasive finishing, abrasive flow finishing, Electro stream drilling, shaped tube electrolytic machining.

TEXT BOOKS:

1. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH.
2. Advanced machining processing- Vijaya.K.Jain/ Allied publications
3. Advanced methods of machining-J.A.Mc.Geough/Springer publications

REFERENCES:

1. New Technology / Bhattacharya A/ the Institution of Engineers, India 1984.
2. Non Traditional Manufacturing Processes / Benedict
3. Fundamentals of Machining Processes-Conventional and non – conventional processes/Hassan Abdel –Gawad El-Hafy/CRC Press-2016.
4. http://www.brainkart.com/article/Unconventional-machining-process_6332/
5. http://nptel.ac.in/courses/112105126/36

Course outcomes:

Student will be able to

CO#	Statement	Cognitive Level
CO1	*Explain the ultrasonic machining process and estimate the material removal rate in the process*	
CO2	*Analyze the different electro-chemical machining process*	
CO3	*Examine the different process parameters for thermal metal removal processes.*	
CO4	*Explain the concept of electro-beam machining and Laser Beam machining process parameters its applications.*	
CO5	*Apply plasma for machining and it's applications*	
CO6	*Build information about various machining processes based on input energy*	

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IV Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

AUTOMOBILE ENGINEERING (16ME8T31)

Course Objectives:

Students will learn:

1. *Working of Automobile components.*
2. *Working of Transmission systems.*
3. *Types of steering mechanism, ignition systems and their working.*
4. *Suspension, Breaking, Electrical systems and their working.*
5. *Safety system in automobiles and specifications for engines*
6. *Engine servicing and Emission standards in automobiles.*

UNIT – I

INTRODUCTION: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, oil filters, oil pumps, air filters, **F**uel pump, nozzle, spray formation, injection timing, testing of fuel pumps,Types of carburetor – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

UNIT – II

TRANSMISSION SYSTEM: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

UNIT – III

STEERING SYSTEM: Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

IGNITION SYSTEM: Function of an ignition system, auto transformer, contact breaker points, condenser and spark plug –electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

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, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.

ELECTRICAL SYSTEM: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – V

ENGINE SPECIFICATION AND SAFETY SYSTEMS: Introduction-engine specifications with regard to power, speed, torque, no. of cylinders and arrangement.

SAFETY: Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control.

UNIT – VI

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

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

TEXT BOOKS:

1. Automotive Mechanics / Heitner
2. Automobile Engineering / William Crouse, TMH Distributors .
3. Automobile Engineering- P.S Gill, S.K. Kataria & Sons, New Delhi.

REFERENCES:

1. Automotive Engines Theory and Servicing, James D. Halderman and Chase D. Mitchell Jr., Pearson education inc.
2. Automotive Engineering / Newton Steeds & Garrett.
3. Automotive Mechanics – Vol. 1 & Vol. 2 / Kripal Singh, standard publishers.

Course Outcomes:

Student will be able to

CO#	Statement	Cognitive Level
CO1	*Explain the working of Automobile components*	
CO2	*Demonstrate the concept of transmission systems*	
CO3	*Demonstrate the concept of steering mechanism.*	
CO4	*Apply concept of suspension system, breaking system and electrical system.*	
CO5	*Apply the engine specification and safety system.*	
CO6	*Analyze the engine emission control and service.*	

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

IV Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

THERMAL EQUIPMENT DESIGN (16ME8D08)
(ELECTIVE – III)

Course Objective:

Students will learn:

1. *Various types of heat exchangers and their working.*
2. *Concepts of designing heat exchangers based on direction of flow.*
3. *Concepts of designing heat exchangers based on constructional features.*
4. Basic knowledge on condensers and perform various calculations.
5. Basic knowledge on vaporizers, evaporators, reboilers and perform various calculations.
6. Design calculations of cooling towers.

UNIT - I:

Classification of heat exchangers: Introduction, Recuperation & Regeneration – Tubular heat exchangers: double pipe, shell & tube heat exchanger, Plate heat exchangers, Gasketed plate heat exchanger, spiral plate heat exchanger, Lamella heat exchanger, extended surface heat exchanger, Plate fin, and Tubular fin.

UNIT - II:

Basic Design Methods of Heat Exchanger: Introduction, Basic equations in design, Overall heat transfer coefficient – LMTD method for heat exchanger analysis – parallel flow, counter flow, multipass, cross flow heat exchanger design calculations.

Double Pipe Heat Exchanger: Film Coefficient for fluids in annulus, fouling factors, calorific temperature, average fluid temperature, the calculation of double pipe exchanger, Double pipe exchangers in series-parallel arrangements.

UNIT - III:

Shell & Tube Heat Exchangers: Tube layouts for exchangers, baffle Heat exchangers, calculation of shell and tube heat exchangers – shell side film coefficients, Shell side equivalent diameter, the true temperature difference in a 1-2 heat exchanger, influence of approach temperature on correction factor, shell side pressure drop, tube side pressure drop, Analysis of performance of 1-2 heat exchanger, and design calculation of shell & tube heat exchangers. Flow arrangements for increased heat recovery, the calculations of 2-4 exchangers.

UNIT - IV:

Condensation of single vapors: Calculation of a horizontal condenser, vertical condenser, De-super heater condenser, vertical condenser – sub-cooler, horizontal condenser – subcooler, vertical reflux type condenser, condensation of steam.

UNIT – V:

Vaporizers, Evaporators and Reboilers: Vaporizing processes, forced circulation vaporizing exchangers, natural circulation vaporizing exchangers, calculations of a reboiler.

Extended Surfaces: Longitudinal fins, weighted fin efficiency curve, calculation of a double pipe fin efficiency curve, calculation of a double pipe finned exchanger, calculation of a longitudinal fin shell and tube exchanger.

UNIT - VI:

Direct Contact Heat Exchanger: Cooling towers, relation between wet bulb & dew point temperatures, the Lewis number, and classification of cooling towers, cooling tower internals and the roll of fill, Heat balance, heat transfer by simultaneous diffusion and convection. Analysis of cooling tower requirements, Design of cooling towers, Determination of the number of diffusion units, calculation of cooling tower performance.

TEXT BOOKS:

1. Process Heat Transfer – D.Q. Kern, TMH.
2. Cooling Towers by J.D. Gurney
3. Heat Exchanger Design – A.P.Fraas and M.N. Ozisick. John Wiely & sons, New York.

Course Objective:

Student will be able to

CO#	Statement	Cognitive Level
CO1	*Define different types of heat exchangers.*	
CO2	*Design the heat exchangers based on LMTD &Effectiveness.*	
CO3	*Design and analyze the shell and tube heat exchanger.*	
CO4	*Apply the fundamental, physical and mathematical aspects of condensation.*	
CO5	*Explain the fundamental, physical and mathematical aspects of boiling.*	
CO6	*Classify cooling towers and explain their technical features.*	

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(Autonomous)

IV Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

NON - DESTRUCTIVE EVALUATION (16ME8D09)
(ELECTIVE-III)

Course Objectives:

Students will learn:

1. *Basics of non-destructive testing and radiographic techniques.*
2. *Concept of ultrasonic testing, equipment and variables affecting ultrasonic test.*
3. *Concept of liquid penetrant test and eddy current testing.*
4. *Fundamentals of magnetic particle testing techniques and equipments.*
5. *Fundamentals of infrared and thermal testing, techniques and equipments.*
6. *Applications of non-destructive testing and evaluation in various industries.*

UNIT-I

INTRODUCTION TO NON-DESTRUCTIVE TESTING AND RADIOGRAPHY TEST: Introduction to NDT and its classification- Radiography test**,** Sources of X and Gamma Rays and their interaction with Matter, Radiography equipment, Radiography Techniques, Safety Aspects of Industrial Radiography.

UNIT-II

ULTRASONIC TEST**:** Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect, Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

UNIT-III

LIQUID PENETRANT TEST: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing.

EDDY CURRENT TEST: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing Effectiveness of Eddy Current Testing.

UNIT-IV

MAGNETIC PARTICLE TEST**:** Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

UNIT-V

INFRARED AND THERMAL TESTING: Introduction and fundamentals to infrared and thermal testing- Heat transfer and passive technique- Lock in and pulse thermography-Contact and non-contact thermal inspection methods- Heat sensitive paints- Heat sensitive papers-thermally quenched phosphors liquid crystals – techniques for applying liquid crystals – other temperature sensitive coatings – inspection methods – Infrared radiation and infrared detectors – thermos

mechanical behavior of materials- IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures- Case studies.

UNIT-VI

INDUSTRIAL APPLICATIONS OF NDE**:** Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions.

TEXT BOOKS:

1. Non-destructive test and evaluation of Materials, J Prasad, GCK Nair, TMHPublishers.
2. Ultrasonic testing by Krautkramer andKrautkramer.
3. Non-destructive testing, Warren, JMcGonnagle / Godan and Breach Science Publishers.

REFERENCES:

1. Ultrasonic inspection training for NDT: E. A. Gingel, Prometheus Press.
2. ASTM Standards, Vol 3.01, Metals andalloys.
3. Non-destructive, Hand Book – R. Hamchand.
4. Nondestructive Testing, Louis Cartz, ASM International
5. Nondestructive Evalution and Quality Control, ASM Handbook, Vol. 17.
6. Nondestructive evaluation of materials by infrared thermography /X. P. V. Maldague,Springer-Verlag 1st edition,(1993)
7. https://www.asnt.org/MinorSiteSections/AboutASNT/Intro-to-NDT
8. nptel.ac.in/courses/113106070/

Course Outcomes:

Student will be able to:

CO#	Statement	Cognitive Level
CO1	*explain the basics of non-destructive testing and radiographic techniques.*	
CO2	*define the different ultrasonic testing techniques*	
CO3	*demonstrate about liquid penetration test and eddy current test.*	
CO4	*analyze the magnetic particle testing techniques and their fundamental concepts.*	
CO5	*demonstrate the concept of infrared and thermal testing.*	
CO6	*apply the nde applications on various industries.*	

PRAGATI ENGINEERING COLLEGE : SURAMPALEM
(Autonomous)

IV Year – II Semester

L	T	P	C
4	**0**	**0**	**3**

QUALITY AND RELIABILITY ENGINEERING (16ME8D10)
(ELECTIVE-III)

Course objectives:

Students will learn:

1. *The approaches and techniques to assess and improve process and/or product quality and reliability*
2. *The principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring.*
3. *The process control and acceptance sampling procedure and their application.*
4. *The tolerance design, QFD matrix ISO standards.*
5. *Techniques of modern reliability engineering tools*
6. *The modern practices in maintenance and reliability techniques.*

UNIT-I

INTRODUCTION: Quality value and engineering – quality systems – quality engineering in product design and production process – system design – parameter design – tolerance design, quality costs – quality improvement.

UNIT-II

STATISTICAL QUALITY CONTROL: Definition of SQC, benefits and limitation of SQC, Statistical process control X, R, P, C charts, other types of control charts, process capability, process capability analysis, process capability index, use of SQC tables.

UNIT-III

ACCEPTANCE SAMPLING: Acceptance sampling based on reliability test – O.C Curves. Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plans.

UNIT-IV

ONLINE METHJODS AND QFD: Loss function, tolerance design – N type, L type, S type; determination of tolerance for these types. online quality control – variable characteristics, attribute characteristics, parameter design. Quality function deployment – house of quality, QFD matrix, total quality management concepts. quality information systems, quality circles, introduction to ISO 9000 standards. Need for ISO 9000- ISO 9000-2000 Quality System.

UNIT-V

RELIABIITY ANALYSIS: Reliability – Evaluation of design by tests - Hazard Models, Linear, Releigh, Weibull. Failure Data Analysis, reliability prediction based on weibull distribution, Reliability improvement.

UNIT-VI

COMPLEX RELIABILITY SYSTEM: Complex system, reliability, reliability of series, parallel & standby systems & complex systems & reliability prediction and system effectiveness. Maintainability, availability, economics of reliability engineering, replacement of items, maintenance costing and budgeting, reliability testing.

TEXT BOOKS:

1. G Taguchi, 'Quality Engineering in Production Systems - Mc Graw Hill.
2. E. Bala Guruswamy, 'Reliability Engineering', Tata McGraw Hill.
3. Montgomery "Statistical Quality Control : A Modern Introduction" Wiley.

REFERENCE BOOKS:

1. Frank.M.Gryna Jr. "Jurans Quality planning & Analysis", McGraw Hill.
2. Philipposs, 'Taguchi Techniques for Quality Engineering', Mc Graw Hill.
3. LS Srinath, 'Reliability Engineering', Affiliated East West Pvt. Ltd..
4. Eugene Grant, Richard Leavenworth "Statistical Process Control", McGraw Hill.
5. W.A. Taylor, 'Optimization & Variation Reduction in Quality', Tata Mc Graw Hill.
6. Quality and Performance Excellence: James R Evans, Cengage learning.
7. https://onlinecourses.nptel.ac.in/noc18_mg02/preview
9. https://onlinecourses.nptel.ac.in/noc17_mg18/preview
10. https://onlinecourses.nptel.ac.in/noc17_mg08/preview
11. https://onlinecourses.nptel.ac.in/noc18_mg04/preview
12. http://nptel.ac.in/courses/110101010/
13. https://onlinecourses.nptel.ac.in/noc17_mg23/preview
14. http://nptel.ac.in/courses/110105039/37

Course outcome:

Students should be able to:

CO#	Statement	Cognitive Level
CO1	*Define Quality concepts and quality improvement*	
CO2	*Summarize the statistical process control and SQC table.*	
CO3	*Explain the concept of acceptance sampling by variables and attributes.*	
CO4	*Build the various characteristics in tolerance design and QFD matrix.*	
CO5	*Explain the concept of reliability and their improvements*	
CO6	*Analyze the modern practices in maintenance*	