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ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

MECHANICAL ENGINEERING

B. TECH. FOUR YEARS DEGREE PROGRAMME

(Applicable for the batches admitted from 2013-14)

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS)

Approved By AICTE, New Delhi
Recognized under 2(f) and 12(b) of UGC
Permanently Affiliated to JNTUK, Kakinada.
K. Kotturu, TEKKALI-532 201, Srikakulam, Andhra Pradesh

VISION OF THE INSTITUTE

To evolve into a premier engineering institute in the country by continuously enhancing the range of our competencies, expanding the gamut of our activities and extending the frontiers of our operations.

MISSION OF THE INSTITUTE

Synergizing knowledge, technology and human resource, we impart the best quality education in Technology and Management. In the process, we make education more objective so that efficiency for employability increases on a continued basis.

DEPARTMENT OF MECHANICAL ENGINEERING

Aditya Institute of Technology and Management established the Department of Mechanical Engineering (ME) in 2004 with an initial intake of 60 students and got approval for additional intake of another 60 seats in 2011-12. A Post Graduate Program (M. Tech) in Thermal Engineering is introduced in 2011-12 with an intake of 18 seats, and the intake is increased to 24 during 2012-13, and it is further increased to 30 during 2014-2015.

The Department of Mechanical Engineering received NBA accreditation in 2013 for 2 years. This Institution is also accredited by NAAC. The college received TEQIP funds in Phase-II under sub-component 1.1. These two important additions surely enhance the prestige of the institution; and in turn help students to improve their academic standards. Both the B. Tech and M. Tech programs are duly approved by the AICTE and Govt. of A.P. and affiliated to JNTUK.

VISION OF THE DEPARTMENT

Mechanical Engineering Department shall be the desirable place for quality education/study and shall emerge as centre of excellence with outstanding faculty, facilities, education and research.

MISSION OF THE DEPARTMENT

1. Mechanical Engineering Program dedicates itself to provide students with a set of skills, knowledge and attitude that will permit its graduates to succeed and thrive as engineers and leaders.
2. The department expands the frontier of knowledge in the field of Mechanical Engineering and improves the professional potential of students and staff through education programs.
3. The department prepares its graduates to pursue life-long learning, serve the profession and meet intellectual, ethical and career challenges
4. The department maintains a vital, state-of-the-art research center to provide its students and faculty with opportunities to create, interpret, apply and disseminate knowledge.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: Possess knowledge and competencies for careers in Mechanical and allied Engineering.

PEO2: Pursue higher education or research or take up entrepreneurial endeavors.

PEO3: Create new methods/processes to meet societys needs with their knowledge of Mechanical Engineering.

PEO4: Demonstrate a commitment to the society and profession through involvement with society and/or professional organizations.

PROGRAM OUTCOMES

After successful completion of B. Tech. Mechanical Engineering, the graduate will be able to

a) Apply knowledge of mathematics, science, and engineering.
b) Design and conduct experiments, as well as analyze and interpret data
c) Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability.
d) Function on multidisciplinary teams.
e) Identify, formulate, and solve engineering problems.
f) Understand professional and ethical responsibility.
g) Communicate effectively.
h) Possess broad education including finance and management necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Recognize the need for, and an ability to engage in life-long learning.
j) Possess knowledge of contemporary issues.
k) Use the techniques, skills, and modern engineering tools necessary for engineering practice.
l) Qualify in competitive examination like GATE, IES etc.

Academic Regulations 2013 for B. Tech.

(Effective for the students admitted into I year from the Academic Year 2013-2014 and onwards)

1. Award of B. Tech. Degree:

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

(a) Pursued a course of study for not less than four academic years and not more than eight academic years.

(b) Registered for **180** credits and he/she must secure total **180** credits.

2. Students, who fail to complete their Four years Course of study within **8** years or fail to acquire the 180 Credits for the award of the degree within **8** academic years from the year of their admission, shall forfeit their seat in B. Tech course and their admission shall stand cancelled.

3. Courses of study:

The following courses of study are offered at present with specialization in the B. Tech. Course.

S. No.	Branch Code-Abbreviation	Branch
01	01-CE	Civil Engineering
02	02-EEE	Electrical and Electronics Engineering
03	03-ME	Mechanical Engineering
04	04-ECE	Electronics and Communication Engineering
05	05-CSE	Computer Science and Engineering
06	12-IT	Information Technology

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

4. Credits (Semester system from I year onwards):

Sl. No	Course	Credits
1	Theory Course	02/03
2	Laboratory Course	02
3	Advanced Laboratory Course	03
3	Self Study course/Internship	01
4	Employability skills	02
5	Project	06

5. Evaluation Methodology:

The performance of a student in each semester shall be evaluated subject – wise with a maximum of **100** marks for theory course and **75** marks for laboratory and other courses. The project work shall be evaluated for **200** marks.

5.1Theory course:

For theory courses the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End - Examinations.

Out of 30 internal marks – **25** marks are assigned for descriptive exam and **5** marks for assignments.

(i) Pattern for Internal Midterm Examinations (25 marks):

For theory courses of each semester there shall be **3** Midterm descriptive/objective exams. Each descriptive/objective exam consists of **120** minutes duration for **25** marks. The average of the best two out of three Mid exams will be taken for the assessment of internal marks.

The first Midterm examination to be conducted usually after **5** weeks of instruction, the second Midterm examination to be conducted usually after **11** weeks of instruction and the third Midterm examination will be conducted usually after **17** weeks of instruction. Each Midterm question paper shall contain **4** questions, out of 4 questions first question is objective type which

contains 10 questions with 1 mark each (10 x 1 =10M) and remaining 3 questions are descriptive type (3 x 10= 30M). The student should answer all **4** questions.

(ii) Pattern for External End Examinations (70 marks):

(a) There shall be an external examination for every theory course and consists of two parts (part-A and part-B). The duration of the time for this end examination is 3 hours.

(b) Part-A shall contain 10 marks , which is compulsory. It has 10 short questions with 1 mark each (10x1=10M). Two questions will be given from each unit.

(c)Part-B of the question paper shall have descriptive type questions for 60 marks. There shall be two questions from each unit with internal choice. Each question carries 12 marks. Each course shall consist of 5 units of syllabus.

5.2 Laboratory Course:

(i) **(a)** For practical subjects there shall be continuous evaluation during the semester for **25** internal marks and **50** semester end examination marks. Out of the **25** marks for internal: **10** marks for day to day work, **5** for record and **10** marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner from outside the college.

(b) For the benefit of the students, two advanced labs are introduced with some specialized areas in each B.Tech. Program.

(ii.) For the course having design and / or drawing, (such as Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for day – to – day work, and 15 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester and the average of the two shall be considered for the award of marks for internal tests.

5.3 Project Work:

Out of a total of 200 marks for the project work, **60** marks shall be for Project 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 made at the end of the IV year. The Internal Evaluation shall be made on the basis of two seminars given by each student on the topic of his project which was evaluated by an internal committee.

5.4 Self Study course:

Four Periods per week (which includes library, e-learning, Internet and presentation) are allotted for this course. Self Study shall be evaluated for 75 Marks.

Out of **75** Marks, **25** marks for day-to-day evaluation and **50** marks on the basis of end examination conducted by internal committee consisting of Head of the Department, Two Senior faculty Members of the department concerned. There shall be no external examination for self-study.

5.5 Audit Course:

Audit course is one among the compulsory courses and does not carry any credits. The audit courses will start from the II year I- semester onwards. The list of audit courses are shown below:

i) Professional Ethics and Morals
ii) IPR & Patents

5.6 Employability Skills:

Employability skills shall be evaluated for **75** marks. **25** marks for day-to-day evaluation and **50** marks on the basis of end (internal) examination. There is no external examination for employability skills.

5.7 Internship:

All the students shall undergo the internship period of **4** weeks and the students have an option of choosing their own industry which may be related to their respective branch. A self study report for

the internship shall be submitted and evaluated during the IV year II-Semester and will be evaluated for a total of **75** marks consists of **25** marks for internal assessment and **50** marks for end examination.

Internal assessment for **25** marks shall be done by the internship supervisor. Semester end examination for **50** marks shall be conducted by committee consists of Head of the Department, internal supervisor and an external examiner.

6. Attendance Requirements:

(i) A student shall be eligible to appear for End Semester examinations, if he/she acquires a minimum of **75%** of attendance in aggregate of all the subjects.

(ii) Condonation of shortage of attendance in aggregate up to **10%** (**65%** and above and below 75%) in each semester with genuine reasons and shall be approved by a committee duly appointed by the college. The condonation approved otherwise it can be reviewed by the College academic committee.

(iii) A Student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester. They may seek re-admission for that semester when offered next.

(iv) Shortage of Attendance below **65%** in aggregate shall in NO case be condoned.

(v) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

(vi) A fee stipulated by the college shall be payable towards condonation of shortage of attendance.

7. Minimum Academic Requirements:

7.1 Conditions for pass and award of credits for a course:

A candidate shall be declared to have passed in individual course if he/she secures a minimum of 40% aggregate marks (Internal & Semester end examination marks put together), subject to a minimum of 35% marks in semester end examination.

a) On passing a course of a programme, the student shall earn assigned credits in that Course.

7.2 Method of Awarding Letter Grades and Grade Points for a Course:

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Table: Grading System for B. Tech., Programme

Percentage	Grade Points	Letter Grade
90-100%	10	S
80-89%	9	A
70-79%	8	B
60-69%	7	C
50-59%	6	D
40-49%	5	E
< 40%	0	F (Fail)

7.3 Calculation of Semester Grade Points Average (SGPA)* for semester:

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

$$SGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR}$$ (for all courses passed in semester)

Where CR = Credits of a Course

GP = Grade points awarded for a course

*SGPA is calculated for the candidates who passed all the courses in that semester.

7.4 Calculation of Cumulative Grade Points Average (CGPA) and Award of Division for Entire Programme:

The CGPA is calculated as below:

$$CGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR} \quad \text{(For entire programme)}$$

Where CR = Credits of a course

GP = Grade points awarded for a course

Table: Award of Divisions

CGPA	DIVISION
≥ 7.75	First Class with distinction
≥ 6.75 and < 7.75	First Class
≥ 5.75 and < 6.75	Second Class
≥ 50.00 and < 5.75	Pass Class
< 5	Fail

7.5 Supplementary Examinations:

Supplementary examinations will be conducted in every semester.

7.6 Conditions for Promotion:

(i) A student will be promoted to second year, if he/she put up the minimum attendance requirement.

(ii) A student shall be promoted from II to III year only if he fulfills the academic requirement of total **50%** credits (if number credits is in fraction, it will be rounded off to lower digit) from regular and supplementary examinations of I year and II year examinations, irrespective of whether the candidate takes the examination or not.

(iii) A student shall be promoted from III year to IV year only if he fulfills the academic requirements of total **50%** credits (if number of credits is in fraction, it will be rounded off to lower digit) from regular and supplementary examinations of I Year, II Year and III Year examinations, irrespective of whether the candidate takes the examinations or not.

(iv) A student shall register and put up minimum attendance in all **180** credits and earn all **180** credits, marks obtained in **180** credits shall be considered for the calculation of percentage of marks.

8. Course pattern:

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

(ii) A student is eligible to appear for the end examination in a subject, but absent for it or failed in the end examinations may appear for that subject's **supplementary** examinations, when offered.

(iii) When a student is detained due to lack of credits / shortage of attendance, he may be re-admitted when the semester is offered after fulfillment of academic regulations. Whereas the academic regulations hold good with the regulations he/she first admitted.

9. **Minimum Instruction Days:**

The minimum instruction days for each semester shall be **95** clear instruction days.

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

11. **General:**

(i) Where the words "he" "him" "his", occur in the regulations, they include "she", "her", "hers".

(ii) The academic regulation should be read as a whole for the purpose of any interpretation.

(iii) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the principal is final.

(iv) The College may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

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ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT: TEKKALI
SRIKAKULAM-532201, Andhra Pradesh (India)
Academic Regulations 2014 for B. Tech. (Lateral Entry Scheme)

(Effective for the students getting admitted into II year from the Academic Year 2014- 2015 and onwards)

1. Award of B. Tech. Degree:

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

(a.) Pursued a course of study for not less than three academic years and not more than six academic years.

(b) Registered for **131** credits and must secure **131** credits.

2. Students, who fail to complete their three year Course of study within six years or fail to acquire the **131** Credits for the award of the degree within **6** academic years from the year of their admission, shall forfeit their seat in B. Tech course and their admission shall stand cancelled.

3. Promotion Rule:

(a) A lateral entry student will be promoted to II year to III year if he puts up the minimum required attendance in II year.

(b) A student shall be promoted from III year to IV year only if he fulfills the academic requirements of total **40%** of credits (if number of credits is in fraction, it will be rounded off to lower digit) from the II Year and III Year examinations , whether the candidate takes the examinations or not.

4. Minimum Academic Requirements:

4.1 Conditions for pass and award of credits for a course:

a) A candidate shall be declared to have passed in individual course if he/she secures a minimum of 40% aggregate marks (Internal & Semester end examination marks put together), subject to a minimum of 35% marks in semester end examination.

b) On passing a course of a programme, the student shall earn assigned credits in that Course.

4.2 Method of Awarding Letter Grades and Grade Points for a Course:

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Table: Grading System for B.Tech. Programme

Percentage	Grade Points	Letter Grade
90-100%	10	S
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70-79%	8	B
60-69%	7	C
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< 40%	0	F (Fail)

4.3 Calculation of Semester Grade Points Average (SGPA)* for semester:

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

$$SGPA = \frac{\Sigma(CR \times GP)}{\Sigma CR}$$ (for all courses passed in semester)

Where CR = Credits of a Course

GP = Grade points awarded for a course

*SGPA is calculated for the candidates who passed all the courses in that semester.

4.4 Calculation of Cumulative Grade Points Average (CGPA) and Award of Division for Entire Programme:

The CGPA is calculated as below:

$$\text{CGPA} = \frac{\Sigma(\text{CR} \times \text{GP})}{\Sigma\text{CR}} \quad \text{(for entire programme)}$$

Where CR = Credits of a course

GP = Grade points awarded for a course

Table: Award of Divisions

CGPA	DIVISION
≥ 7.75	First Class with distinction
≥ 6.75 and < 7.75	First Class
≥ 5.75 and < 6.75	Second Class
≥ 50.00 and < 5.75	Pass Class
< 5	Fail

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

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

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

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

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

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKLAI - 532 201
AUTONOMOUS INSTITUTE Affiliated to JNTU Kakinada

DEPARTMENT OF MECHANICAL ENGINEERING

B.TECH COURSE STRUCTURE

I YEAR

I B. Tech - I Semester			L	T	P	C	Marks		
							Int.	Ext.	Total
1	13HS1001	English –I	3	1	-	3	30	70	100
2	13BS1001	Engineering Mathematics – I	3	1	-	3	30	70	100
3	13BS1002	Engineering Mathematics – II	3	1	-	3	30	70	100
4	13CS1001	Computer Programming	3	1	-	3	30	70	100
5	13ME1001	Engineering Drawing	1	-	3	3	30	70	100
6	13BS1004	Engineering Physics	3	1	-	3	30	70	100
7	13CS1101	Computer Programming Lab	-	-	3	2	25	50	75
8	13ME1101	Engineering Workshop	-	-	3	2	25	50	75
9	13BS1101	Engineering Physics Lab	-	-	3	2	25	50	75
Total		**(33 periods)**	**16**	**5**	**12**	**24**	**255**	**570**	**825**

I B. Tech - II Semester			L	T	P	C	Marks		
							Int.	Ext.	Total
1	13HS1002	English – II	2	1	-	2	30	70	100
2	13HS1003	Environmental Studies	3	1	-	3	30	70	100
3	13BS1003	Engineering Mathematics – III	3	1	-	3	30	70	100
4	13EE1002	Basic Electrical and Electronics	3	1	-	3	30	70	100
5	13ME1002	Classical Mechanics	3	1	-	3	30	70	100
6	13BS1005	Engineering Chemistry	3	1	-	3	30	70	100
7	13HS1101	Basic English Language Communication Skills Lab	-	-	3	2	25	50	75
8	13BS1102	Engineering Chemistry Lab	-	-	3	2	25	50	75
9	13CS1103	Information Technology Workshop Lab	-	-	3	2	25	50	75
10	13EE1102	Electrical and Electronics Engineering Lab	-	-	3	2	25	50	75
Total		**(35 periods)**	**17**	**6**	**12**	**25**	**280**	**620**	**900**

L – Lecture

T- Tutorial

P- Practical

II YEAR

II B. Tech - I Semester			L	T	P	C	Marks		
							Int.	Ext.	Total
1	13BS2007	Complex Variables & Statistical Methods	3	1	-	3	30	70	100
2	13ME2004	Mechanics of Solids	3	1	-	3	30	70	100
3	13ME2005	Production Technology	3	1	-	3	30	70	100
4	13ME2006	Engineering Metallurgy & Material Science	3	1	-	3	30	70	100
5	13ME2007	Thermodynamics	3	1	-	3	30	70	100
6	13ME2103	Metallurgy / MOS Lab	-	-	3	2	25	50	75
7	13ME2104	Production Technology Lab	-	-	3	2	25	50	75
8	13HS2102	Advanced English Language Communication Skills Lab	-	-	3	2	25	50	75
9	13ME2102	Advanced Engineering Drawing Practice	1	-	3	2	25	50	75
10	13ME2201	Self Study Course – I*	4	-	-	1	75	-	75
Total			**20**	**5**	**12**	**24**	**325**	**550**	**875**

***4 Periods which include library, e-learning, internet and presentation.**

II B. Tech – II Semester			L	T	P	C	Marks		
							Int.	Ext.	Total
1	13HS2004	Managerial Economics and Financial Analysis	3	1	-	3	30	70	100
2	13ME2008	Fluid Mechanics and Hydraulic Machinery	3	1	-	3	30	70	100
3	13ME2009	Kinematics of Machinery	3	1	-	3	30	70	100
4	13ME2010	Design of Machine Members - I	3	1	-	3	30	70	100
5	13ME2011	Thermal Engineering - I	3	1	-	3	30	70	100
6	13ME2012	Machine Drawing	2	-	4	3	30	70	100
7	13ME2105	CAD & MAT Lab	-	-	3	2	25	50	75
8	13ME2106	Fluid Mechanics and Hydraulic Machinery Lab	-	-	3	2	25	50	75
9	13HS2201	Professional Ethics & Morals	2	-	-	--	----	----	----
Total			**19**	**5**	**10**	**22**	**230**	**520**	**750**

III YEAR

III B. Tech - I Semester			L	T	P	C	Marks		
							Int.	Ext.	Total
1	13ME3013	Dynamics of Machinery	3	1	-	3	30	70	100
2	13ME3014	Metal Cutting and Machine Tools	3	1	-	3	30	70	100
3	13ME3015	Design of Machine Members - II	3	1	-	3	30	70	100
4	13ME3016	CAD/CAM	3	1	-	3	30	70	100
5	13ME3017	Thermal Engineering - II	3	1	-	3	30	70	100
6	13ME3107	3D Modeling Lab	-	-	4	3	25	50	75
7	13ME3108	Thermal Engineering Lab	-	-	3	2	25	50	75
8	13ME3109	Machine Tools Lab	-	-	3	2	25	50	75
9	13ME3202	Self Study Course – II*	4	-	-	1	75	--	75
Total			**19**	**5**	**10**	**23**	**300**	**500**	**800**

***4 Periods which include library, e-learning, internet and presentation.**

III B. Tech - II Semester			L	T	P	C	Marks		
							Int.	Ext.	Total
1	13ME3018	Metrology	3	1	-	3	30	70	100
2	13EI3002	Instrumentation and Control Systems	3	1	-	3	30	70	100
3	13ME3019	Industrial Engineering and Management	3	1	-	3	30	70	100
4	13ME3020	Heat Transfer	3	1	-	3	30	70	100
5	13ME3021	Operations Research	3	1	-	3	30	70	100
6		**Elective 1**	3	1	-	3	30	70	100
	13ME3022	Tool Design							
	13ME3023	Database Management Systems							
	13ME3024	Condition Monitoring & Maintenance Engineering							
	13ME3025	Automobile Engineering							
7	13ME3110	Metrology & Instrumentation Lab	-	-	3	2	25	50	75
8	13ME3111	Production Drawing Practice	-	-	3	2	25	50	75
9	13HS3202	IPR & Patent	2	-	-	-	-	-	-
Total			**20**	**6**	**6**	**22**	**230**	**520**	**750**

IV YEAR

IV B. Tech - I Semester			L	T	P	C	Marks		
							Int.	Ext.	Total
1	13ME4026	Refrigeration & Air Conditioning	3	1	-	3	30	70	100
2	13ME4027	Finite Element Methods	3	1	-	3	30	70	100
3	13ME4028	Industrial Hydraulics & Pneumatics	3	1	-	3	30	70	100
4		**Elective 2**	3	1	-	3	30	70	100
5		**Open Elective**	3	1	-	3	30	70	100
6	13ME4112	Pneumatics and Hydraulics Lab	-	-	3	2	25	50	75
7	13ME4113	Heat Transfer Lab	-	-	3	2	25	50	75
8	13ME4114	CAE Lab	-	-	4	3	25	50	75
9	13HS4203	Employability skills	-	-	3	2	75	--	75
Total		**(33 periods)**	**15**	**5**	**13**	**24**	**300**	**500**	**800**

Elective 2	
13ME4029	Power Plant Engineering
13ME4030	Robotics
13ME4031	Tribology
13ME4032	Mechatronics

IV B. Tech - II Semester			L	T	P	C	Marks		
							Int.	Ext.	Total
1	13ME4033	Production Planning and Control	3	1	-	3	30	70	100
2		**Elective 3**	3	1	-	3	30	70	100
3		**Elective 4**	3	1	-	3	30	70	100
4	13ME4203	Internship	-	-	-	1	25	50	75
5	13ME4204	Project work	-	-	-	6	60	140	200
Total		**(12 periods)**	**9**	**3**	**-**	**16**	**175**	**400**	**575**

Elective 3		Elective 4	
13ME4034	Industrial Automation	13ME4038	Quality & Reliable Engineering
13ME4035	Nonconventional Sources of Energy	13ME4039	Computational Fluid Dynamics
13ME4036	Fuzzy Logic Systems & Neural Networks	13ME4040	Un Conventional Machining Processes
13ME4037	Nano Technology	13ME4041	Design for Manufacturing & Assembly

OPEN ELECTIVE			
13OE4001	Air Quality Management	13OE4006	Optimization Techniques
13OE4002	Cyber Laws	13OE4007	Renewable Energy
13OE4003	Entrepreneurial Development	13OE4008	Advanced Materials
13OE4004	Industrial Safety & Environment	13OE4009	Total Quality Management
13OE4005	MEMS		

Total credits: 49+46+45+40 = 180 Credits

I Year B. Tech., I Semester

ENGLISH - I
(Common to all Branches)

Subject Code: 13HS1001 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To improve the language proficiency of a technical under-graduate in English with emphasis on LSRW skills.
- To provide learning environment to practice listening, speaking, reading and writing skills.
- To effectively integrate English language learning with employability skills and training.
- To provide hands-on experience through case-studies, mini-projects, group and individual presentations.
- To expose the students to a variety of self - instructional modes of language learning.

COURSE OUTCOMES:

On completion of this course, students should be able to

- **Use** English language in their day-to-day life.
- **Employ** LSRW skills within and beyond the classroom environment.
- **Integrate** English Language Learning with employability skills.
- **Demonstrate** better with more observation and practice.
- **Relate** classroom language learning to the real life situations.
- **Interpret** things and draw **inferences** accordingly.

SYLLABUS

UNIT – I

Lost Forests by Johannes V Jensen
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

UNIT – II

More than 100 million women missing by *Amartya Sen*
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

UNIT – III

Three Days to See – Helen Keller
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

UNIT – IV

Reaching the Stars – Kalpana Chawla
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

UNIT – V

Kalahandi by Jagannath Prasad Das
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

TEXT BOOKS:

1. Preparing for the Future by Ed. D. Ravikumar et al., Maruti publishers

REFERENCE BOOKS:

1. The Story of My Helen Keller
2. Kalpana Chawla: A Life – Padmanabhan, Anil
3. Word Power Made Easy – Norman Lewis

I Year B. Tech., I Semester

ENGINEERING MATHEMATICS -I
(Common to all Branches)

Subject Code: 13BS1001 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- Solve the 1st order differential equations choosing suitable method and apply to estimate population, temperature, quantity and trajectory.
- Solve a 2nd and higher order differential equations with constant coefficients, choosing suitable rule & apply to LCR Circuits and Simple Harmonic equations.
- Write Taylor series and Mc Laurent's series for two variable functions and calculate extreme values of two variable functions, three variable functions with constraints.
- Solve the single, multiple integrals, calculate surface and volume of solids choosing suitable integral, calculate the moment of inertia.
- Calculate gradient, divergence, curl of a function. To solve line, surface and volume integrals and apply to calculate work done, area volume. Evaluate multiple integrals using suitable vector integral theorems.

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COURSE OUTCOMES:

On completion of this course, students should be able to

- Can solve the 1^{st} order differential equations choosing suitable method and apply to estimate population, temperature, quantity and trajectory.
- Can solve a 2^{nd} and higher order differential equations with constant coefficients, choosing suitable rule & apply to LCR Circuits and Simple Harmonic equations.
- Can identify Taylor series and Mc Laurent's series for two variable functions and calculate extreme values of two variable functions, three variable functions with constraints.
- Can solve the single, multiple integrals, calculate surface and volume of solids choosing suitable integral, and calculate the moment of inertia.
- Can calculate gradient, divergence, curl of a function, solve line, surface and volume integrals and apply to calculate work done, area, volume. Evaluate the multiple integrals by integrating suitable vector integral theorems.

UNIT – I

Linear Differential Equations of first order:

Linear differential equations of first order and first degree – exact, linear and Bernoulli. Applications: Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories. [10 periods]

UNIT-II

Linear Differential Equations of Second and higher order:

Linear differential equations of second and higher order with constant coefficients- Complete solution, Operator D, Rules for finding complementary function, Inverse operator D, Rules for finding particular integral with RHS term of the type e^{ax} , Sin ax, cos ax, polynomials in x, e^{ax} V(x, xV(x. Method of variation of parameters.

Applications: LCR circuit, Simple Harmonic motion

UNIT-III

Partial Differentiation:

Introduction-Total derivative - Chain rule - Generalized Mean Value theorem for single variable (without proof-Taylors and Mc Laurent's series for two variables – Functional dependence – Jacobian.

Application: Maxima and Minima of functions of two variables with constraints and without constraints.

UNIT-IV

Multiple Integrals:

Applications of Integration to Lengths, Volumes and Surface areas of revolution in Cartesian and Polar Coordinates.

Multiple integrals - double and triple integrals – change of variables – Change of order of Integration- Cartesian and Polar coordinates.

Application: Moment of inertia

UNIT-V

Vector Calculus:

Vector Differentiation: Gradient- Divergence- Curl - Laplacian and second order operators- Vector identies.

Vector Integration - Line integral – work done – Potential function – area- surface and volume integrals. Vector integral theorems: Greens, Stokes and Gauss Divergence Theorems (Without proof and related problems.

Applications: Work done, Force.

TEXT BOOKS:

1. Higher Engineering Mathematics, 42nd edition, 2012 - B. S. Grewal, Khanna Publishers, New Delhi.
2. Engineering Mathematics, Volume-I, 11th editions respt., 2012, Dr. T.K.V.Iyengar & others, S. Chand Publishers.

REFERENCE BOOKS:

1. Engineering Mathematics, 4th edition, 2009 - B. V. Ramana, Tata McGraw Hill, New Delhi.
2. A Text Book of Engineering Mathematics – I & II, 2nd edition, 2011, U. M. Swamy & others – Excel Books, New Delhi.
3. Advanced Engineering Mathematics, 8th edition, 2009, Erwin Kreyszig- Shree Maitrey Printech Pvt.Ltd, Noida.

ENGINEERING MATHEMATICS – II
(Common to all Branches)

Subject Code: 13BS1002 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- Solve the algebraic and transcendental equations, using different numerical method. Estimate the best curve for a given data.
- Calculate the value of dependent variable for a particular x by deducing the unknown function y=f(x) for an evenly or unevenly spaced points, estimate the value of derivatives, evaluate the definite integrals using different numerical methods.
- To calculate the numerical solution of an ordinary differential equation i.e IVP .
- Deduce Laplace transform of continuous functions using Laplace transform formulae & properties. Apply Laplace transform to solve I.V.P &B.V.P
- Solve linear and non-linear 1^{st} order partial differential equation. Evaluate wave equations & heat equations, using method of separation of variables.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Can solve the algebraic and transcendental equations by different numerical methods and estimate a linear and non-linear curve to the given data by the method of least squares.
- Can calculate the value of dependent variable for a particular x by deducing the unknown function y = f(x) for an evenly or unevenly spaced points, estimate the value of derivatives, evaluate the definite integrals using different numerical methods.
- Can calculate the numerical solution of an ordinary differential equation i.e IVP .
- Can deduce Laplace transform of continuous functions using Laplace transform formulae & properties. Apply Laplace transform to solve I.V.P & B.V.P
- Can solve linear and non - linear 1^{st} order partial differential equation. Evaluate wave equations & heat equations using method of separation of variables.

UNIT – I

Algebraic and Transcendental Equations and Curve fitting:

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

Curve fitting: Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares.

UNIT-II

Interpolation and Numerical Differentiation and Integration:

Interpolation: Introduction – 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 unevenly spaced points – Lagrange's Interpolation formula.

Numerical Differentiation and Integration – Differentiation using finite differences – Trapezoidal rule – Simpson's 1/3 Rule –Simpson's 3/8 Rule.

UNIT-III

Numerical solution of Ordinary Differential equations:

Solution by Taylor's series – Picard's Method of successive Approximations – Euler's and Modified Euler's Method – Runge – Kutta Methods – Predictor – Corrector Methods – Milne's Method.

UNIT-IV

Laplace and Inverse Laplace transforms:

Laplace transforms of standard functions – Shifting Theorems, Transforms of derivatives and integrals – Unit step function – Dirac's delta function – Inverse Laplace transforms – Convolution theorem.

Application: Solution of ordinary differential equations using Laplace transforms.

UNIT-V

Partial Differential equations:

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange equation and non-linear (standard type equations. Solution of linear Partial differential equations with constant coefficients – Method of Separation of Variables.

Applications: One dimensional Wave and Heat equations.

TEXT BOOKS:

1. Higher Engineering Mathematics, 42nd edition, 2012 - B. S. Grewal, Khanna Publishers, New Delhi.
2. Ravindranath, V. and Vijayalaxmi, A., 2nd edition, 2012, A Text Book on Mathematical Methods, Himalaya Publishing House, Bombay.

REFERENCE BOOKS:

1. Mathematical Methods, 6th edition, 2011, Dr. T. K.V.Iyengar & others S. Chand Publications.
2. Engineering Mathematics, 4th edition, 2009 - B. V. Ramana, Tata McGraw Hill, New Delhi.
3. Engineering Mathematics Volume-II, 6th edition, 2012, T.K.V Iyengar, &others, S.Chand Co. New Delhi.

I Year B. Tech., I Semester

COMPUTER PROGRAMMING
(Common to all Branches)

Subject Code: 13CS1001 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To impart adequate knowledge on the need of programming languages and problem solving techniques.
- To develop programming skills using the fundamentals and basics of C Language.
- To enable effective usage of arrays, structures, functions, pointers and to implement the memory management concepts.
- To teach the issues in file organization and the usage of file systems.
- To impart the knowledge about pointers which is the backbone of effective memory handling
- To study the advantages of user defined data type which provides flexibility for application development
- To teach the basics of preprocessors available with C compiler.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Understand the fundamentals of C programming.
- Choose the loops and decision making statements to solve the problem.
- Implement different operations on arrays and solve problems using functions.
- Understand pointers, structures and unions.
- Implement file operations in C programming for a given application.

UNIT-I:

Problem Solving: Definition of a Problem, A Framework for Problem Solving, Classification of Problems, Algorithms / Pseudo code- Definition, Properties, Flowchart- Introduction, Introduction to RAPTOR Tool, Flowchart examples for simple computational problems, Program Development Steps, Computer Languages- Machine, Symbolic and High-level, Creating and Running Programs: writing, editing, compiling, linking and executing.

C Fundamentals, Character set, C tokens (Identifier and Keywords, Data types, Constants, variables, Declarations, Expressions, Statements

C Operators: Arithmetic, Unary, Relational and Logical, Assignment and Conditional Operators, Library Functions. Bit Operations and Boolean Logic

UNIT-II:

CONTROL STRUCTURES: if statement, if…else statement-various forms of if, nested if.

ITERATIVE LOOPS: while, do-while and for statements, initialization and updating, event and counter controlled loops, looping applications, break statement, continue statement, goto statement, switch statement, nested switch statement, comma statement.

UNIT-III:

FUNCTIONS – MODULAR PROGRAMMING: Functions, basics, parameter passing, Storage classes-extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, Recursive solutions, header files, example c programs. Passing 1-D arrays, 2-D arrays to functions, parameter passing mechanisms (passing by value, storage classes (auto, register, extern, static, scope of variable

ARRAYS: Arrays - concepts, declaration, definition, accessing elements, storing elements, Strings concepts, String handling functions and string manipulations, 1-D arrays, 2-D arrays and character arrays, Multidimensional arrays , Array applications: Matrix Operations

UNIT-IV:

POINTERS: Pointer definition, pointers concepts, initialization of pointer variables, pointers and function arguments, passing by address, dangling memory, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory management functions, command line arguments.

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

UNIT-V:

FILE HANDLING: Input and output – concept of a file, Creating, processing, opening and closing – Bitwise Operations, text files and binary files, Formatted I/o, file I/o operations, example programs. C pre-processor

TEXT BOOKS:

1. "The C – Programming Language", B.W. Kernighan, Dennis M. Ritchie, PHI
2. "Let Us C", Yashwant Kanitker, Second Edition

REFERENCE BOOKS:

1. "C and data structures: A Snap Shot Oriented Treatise Using Live Engineering Examples" by Dr. N.B. Venkateswarlu, S Changd & Co, New Delhi.
2. "C Programming: A Problem- Solving Approach", Forouzan, E. V. Prasad, Giliberg, Cengage, 2010.
3. "Programming in C", Stephen G. Kochan, 3/e Pearson, 2007
4. Web-link: http://raptor.martincarlisle.com/

I Year B. Tech., I Semester

ENGINEERING DRAWING
(Common to all Branches)

Subject Code: 13ME1001 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:
- Able to develop drawing skills and representation of I angle and III angle projection, isometric Projection, Isometric drawing.

COURSE OUTCOMES:
On completion of this course, students should be able to
- Construct polygons, ellipse and scales (plain, diagonal, vernier.
- Draw orthographic projection of points and straight lines in any quadrant, and determine its true length and true inclination.
- Draw projections of plane surfaces inclined to either one or both reference planes.
- Draw projections of simple solids inclined to one reference plane.
- Convert orthographic views into isometric projections and vice-versa.

UNIT-I
Lettering and Dimensioning: Introduction to various terms; instruments IS 9609 provision, lettering practice. Elements of dimensioning and systems of dimensioning.

Construction of scales: Plain Scale, Diagonal & Vernier Scales.

Geometric Constructions and Engineering Curves: Construction of Polygons, Construction of Conic sections–parabola, ellipse and hyperbola using General Method, construction of ellipse using oblong, arc's of circles and concentric circles methods.

UNIT-II
Orthographic Projections: First and Third Angle Projections:
Projections of Points. Projections of Straight Lines inclined to one reference plane.

UNIT-III
Projections of planes - Perpendicular planes & planes inclined to one reference plane and both reference planes.

UNIT-IV
Projections of solids: Classification of solids. Projections of Prism, Cylinder, Pyramid & Cone inclined to one reference plane.

UNIT-V
Conversion of Orthographic Projections to Isometric Projections: Conversion of Orthographic View to Isometric views

Conversion of Isometric Projection to Orthographic Projections: Conversion of Isometric view to Orthographic views

TEXT BOOKS:
1. Engineering Drawing, by N. D. Bhatt & V. M Panchal, Charotar Publishing House.
2. Engineering Drawing, by K. L .Narayana & P.Kanniah

REFERENCE BOOKS:

1. K. Venugopal, Engineering Drawing and Graphics, 2nd Ed. New Age International.
2. Luzadder, Warren, J. and Jon. D. M., "Fundamentals of Engineering Drawing", 11th Edition, Prentice Hall India.

I Year B. Tech., I Semester

ENGINEERING PHYSICS
(Common to all Branches)

Subject Code: 13BS1004 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To realize the principles of optics in designing optical devices
- To comprehend the Principles of Lasers and Fiber Optics
- To appreciate general principles of crystal and molecular structures and infer X-ray diffraction as an experimental method for determining crystal structures
- To possess an insight on Magnetic Properties and Dielectric Materials pertaining to Material Fabrication
- To define the shortcoming of classical physics and describe the need for modifications to classical theory

COURSE OUTCOMES:

On completion of this course, students should be able to

- Apply the principles of optics in designing optical devices
- Outline the Principles of Lasers and Fiber Optics
- Explain general principles of crystal and molecular structures and infer X-ray diffraction as an experimental method for determining crystal structures
- Interpret the knowledge of Magnetic Properties and Dielectric Materials in Material Fabrication
- Resolve the discrepancies in classical estimates through quantum principles

UNIT- I: WAVE OPTICS

Interference

Introduction, Principle of Superposition of Waves, Coherence –Young's Double Slit Experiment – Intensity Distribution and Fringe Width, Interference in Plane Parallel Film due to Reflected Light, Newton's Rings under Reflected Light - Determination of Wavelength of Monochromatic Source of Light.

Diffraction

Introduction, Types of Diffraction [Fresnel & Fraunhofer], Fraunhofer Diffraction due to Single Slit – Intensity Distribution Differences between Interference and Diffraction,

UNIT-II: LASERS & FIBER OPTICS

Lasers

Introduction, Characteristics of Lasers- Coherence, Directionality, Monochromacity and High Intensity, Principle of Laser – Absorption, Spontaneous and Stimulated Emission; Einsteins's Coefficients, Population Inversion, Optical Resonator and Lasing Action, Ruby Laser, Helium-Neon Laser, Applications of Lasers in Industry, Scientific and Medical Fields.

Fiber Optics

Introduction, Principle of Optical Fiber – Total Internal Reflection, Conditions for Light to Propagate - Numerical Aperture and Acceptance Angle, Optical Fiber Construction, Types of Optical Fibers – Step Index Fibers and Graded Index Fibers, Differences between Step Index Fibers and Graded Index Fibers, Differences between Single Mode Fibers and Multimode Fibers, Advantages of Optical Fibers in Communications.

UNIT-III: INTRODUCTORY SOLID STATE PHYSICS

Crystal Structure

Introduction, Basic Terms – Lattice, Basis, Crystal Structure, Coordination Number, Atomic Radius, Packing Fraction, Free Volume, Lattice Parameters, Unit Cell and Primitive Cell, Crystal Systems and Bravais Lattices, Structure and Packing Fractions of Simple Cubic, Body Centered Cubic and Face Centered Cubic Crystal Structures.

X-Ray Diffraction

Crystal Planes, Directions and Miller Indices, Distance of Separation between successive hkl Planes – Inter Planar Spacing, Diffraction of X-Rays by Crystal Planes – Bragg's Law;

UNIT-IV: ESSENTIALS OF MATERIAL SCIENCE

Magnetic Properties

Introduction, Basic Terms – Magnetic Flux (φ, Magnetic Flux Density or Magnetic Field Induction (B, Magnetic Field Intensity or Magnetic Field Strength (H, Intensity of Magnetization (I, Permeabilty (μ & Relative Permeability (μ_r and Susceptibility (χ, Relation between B, H & I, Relation between Relative Permeability and Susceptibility, Origin of Magnetic Moment – Bohr Magneton, Classification of Magnetic Materials – Dia, Para and Ferro, Domain Theory of Ferromagnetism – Hysteresis Curve; Soft and Hard Magnetic Materials.

Dielectric Properties

Introduction, Basic Terms – Electric Field (E, Electric Dipole, Electric Dipole Moment (μ_e, Polarizability (α, Polarization Vector (P, Displacement Vector (D, Permittivity (ε and Relative Permittivity or Dielectric Constant (ε_r, and Electric Susceptibility (χ_e, Relation between D, E & P, Relation between Relative Permittivity and Susceptibility, Electronic Polarizability, Ionic Polarizability, Orienational Polarizability and Total Polarizability, Definitions of Ferro Electricity and Piezoelectricity.

UNIT-V: FREE ELECTRON THEORY & PRELIMINARY QUANTUM MECHANICS

Free Electron Theory

Introduction, Classical Free Electron Theory, Mean free path, Relaxation time, Drift velocity, Mobility, Current Density and Electrical Conductivity,

Preliminary Quantum Mechanics

Introduction, Waves and Particles, Wave Particle Duality and De-Broglie Hypothesis, Experimental Verification – G. P. Thomson Experiment, Time independent Schrödinger wave equation, Physical Significance of Wave Function, Particle in One Dimensional Potential Box.

TEXT BOOKS:

1. Engineering Physics by Mani Naidu, Pearson Publications Chennai
2. A Text Book Of Engineering Physics by Ksheera Sager and Avadhanulu
3. Engineering Physics by Gaur and Gupta

REFERENCE BOOKS:

1. University Physics by Young and Freedman 12th Edition.
2. Fundamental of Physics by Resnick, Halliday and Walker

I Year B. Tech., I Semester

COMPUTER PROGRAMMING LAB
(Common to all Branches)

Subject Code: 13CS1101 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To provide the student with the necessary skills to write and debug programs using the C programming language
- To provide coverage of basic structure of c programming language
- To provide an understanding of the major modules of c programming language

COURSE OUTCOMES:

On successful completion of this module, students should be able to

- Solve the given problem using the syntactical structures of C language.
- Develop, execute solution for various problems using the Control structures of C language .
- Design programs involving arrays.
- Implement modularity and code reusability concepts using functions.
- To read and write C program that uses pointers, structures and Unions.
- Implement the C programs using files.

Exercise 1

a) Write C programs for calculating • Temperature conversions • Income tax • Area of triangle
b) Write a C program that reads an integer 'n' and rotate 'n' bit positions
c) Write a C program to swap contents of two variables without using third variable.

Exercise 2

a) Write a C program to find the student's grade for given marks.
b) Write a C program to find the greatest of 3 given numbers.
c) Write a C program which takes two integer operands and one operator from the user, perform the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement

Exercise 3

a Write a C program to find the sum of individual digits of a positive integer.
b Write a C program to generate the first 'n' terms of the Fibonacci sequence.
c Write a C program to generate all the prime numbers between 1 and 'n'.
d Write a C program to find the reverse a given number.

Exercise 4

a Write a C program for Addition and multiplication of two Matrices.
b Write a C program to find the transpose of a matrix in in-place manner.

Exercise 5

Write a C program that uses functions to perform the following operations:
a To insert a sub-string in to given main string from a given position.
b To delete n Characters from a given position in a given string.
c Simple programming examples to manipulate strings.
d Verifying a string for its palindrome property

Exercise 6

Write C programs that use both recursive and non-recursive functions for the following

a To find the factorial of a given integer.

b To find the GCD (greatest common divisor of two given integers.

Exercise 7

a Write a C functions to find both the largest and smallest number of an array of integers.

b Write a C function that uses functions to perform the following:

i that displays the position/ index in the string S where the string T begins, or –1 if S doesn't contain T.

ii to count the lines, words and characters in a given text.

Exercise 8

a Write a C function to generate Pascal's triangle.

b Write a C function to construct a pyramid of numbers.

c Write a C function to read in two numbers, x and n, and then compute the sum of this geometric progression: $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$

Exercise 9

a. Write a C program Pointer based function to exchange value of two integers using passing by address.

b. Write a C program which explains the use of dynamic arrays.

c. Write a C program to enlighten dangling memory problem (Creating a 2-D array dynamically using pointer to pointers approach.

Exercise 10

Write C programs for Examples which explores the use of structures, union and other user defined variables

Exercise 11

Write a C program that uses functions to perform the following operations using Structure:

a Reading a complex number b Writing a complex number

c Addition of two complex numbers d Multiplication of two complex numbers

Exercise 12

a Write a C program which copies one file to another.

b Write a C program to reverse the first n characters in a file.

(Note: The file name and n are specified on the command line

REFERENCE BOOKS:

1. C and data structures – Dr. N.B Venkateswarlu, B.S. Publications.
2. C Programming: A Problem - Solving Approach, Forouzan, E. V. Prasad, Giliberg, Cengage, 2010.
3. Programming in C, Stephen G. Kochan, 3/e Pearson, 2007
4. The C – Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI

I Year B. Tech., I Semester

ENGINEERING WORKSHOP
(Common to all Branches)

Subject Code: 13ME1101 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- The Engineering Workshop Practice for engineers is a training lab course spread over entire semester. The modules include training on different trades like Fitting, Carpentry, Black smithy etc… which makes the students to learn how various joints are made using wood and other metal pieces.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Make half-lap, mortise & tenon, corner dovetail or bridle wooden joints.
- Develop sheet metal into objects like square tray, taper side tray, conical funnel or elbow pipe.
- Forge MS rod from round to square cross-section, or into L- or S- bend.
- Fabricate MS pieces into either a straight, square, dovetail or V-fit.
- Connect a staircase or a tube light house-wiring electrical circuit.

I. Wood Working Technology - Familiarity with different types of woods used and tools used in wood Working technology.

Tasks to be performed:

1 To make Half – Lap joint 2 To make Mortise and Tenon joint
3 To make Corner Dovetail joint 4 To make Briddle joint.

II. Sheet Metal Working – Familiarity with different types of tools used in sheet metal working, developments of sheet metal jobs from GI sheets, knowledge of basic concepts of soldering.

Tasks to be performed:

1 To make Square Tray 2 To make Taper side Tray
3 To make Conical Funnel 4 To make Elbow Pipe.

III. Forging Technology – Familiarity with different types of tools used in forging technology. Knowledge of different types of furnaces like coal fired, electrical furnaces etc...

Tasks to be performed:

1 To make round M.S rod to square bar 2 To make L bend in given M.S. Rod.
3 To make S bend in given M.S. Rod. 4 To perform heat treatment tests like annealing, normalizing etc...

IV. Fitting Technology – Familiarity with different types of tools used in fitting technology.

Tasks to be performed:

1 To make "V" – fitting 2 To make square fitting
3 To make Dovetail fitting 4 To make Straight fitting

V.HOUSE WIRING

1 Tube light connection
2 Staircase connection

Note: **Any two jobs from each trade must be performed by the student.**

I Year B. Tech., I Semester

ENGINEERING PHYSICS LAB
(Common to all Branches)

Subject Code: 13BS1101 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE DESCRIPTION

This Laboratory course is intended to apply the Scientific Method to expedite experiments that include

- Mechanics
- Wave Fundamentals
- Physical/Wave Optics
- Modern Physics
- Solid State Devices
- Electromagnetic Induction

So that student can verify theoretical ideas and concepts covered in lecture through host of Analytical Techniques, Statistical Analysis and Graphical Analysis

SCOPE

This course is offered for all First Year B. Tech students either in SEM-I or SEM-II.

- Student will get acquainted with Determination of Rigidity Modulus and Acceleration due to Gravity using Torsional Pendulum and Compound Pendulum respectively.
- The learner is expected to understand Wave Phenomena such as Laws of Stretched Strings apart from Variation of Magnetic Field along the Axis of Circular Coil through Electromagnetic Induction
- Student will be familiar with Optical Equipment such as Traveling Microscope and Spectrometer to understand the phenomena of Interference and Diffraction that will enable him to appreciate the precision measurements.
- The Modern Physics Experiments include introduction to Cutting Edge Technology such as Lasers and Fiber Optics in addition to the Solid State Devices such as Thermistor and Energy Band Gap of a typical Diode

COURSE OBJECTIVES:

- To Interpret the results of mechanical parameters such as modulus of elasticity and acceleration due to gravity through simple oscillatory experiments using torsional pendulum or physical pendulum
- To use classic experimental techniques to understand the Phenomenon of resonance with equipment such as sonometer, Melde's apparatus and volume resonator to measure desired properties
- To operate optical systems and design Instrumentation thereof with targeted accuracy with physical measurements
- To attain ability to use Techniques and Skills associated with Modern Engineering Tools such as Lasers and Fiber Optics
- To characterize magnetic, dielectric and semiconducting material devices

COURSE OUTCOME:

On completion of this course, students should be able to

- Infer the results of mechanical parameters such as modulus of elasticity and acceleration due to gravity through simple oscillatory experiments using torsional pendulum or physical pendulum
- Apply classic experimental techniques to comprehend the Phenomenon of resonance with equipment such as sonometer, Melde's apparatus and volume resonator to measure desired properties
- Demonstrate the ability to measure properties of optical systems and design Instrumentation thereof with targeted accuracy for physical measurements
- Illustrate Techniques and Skills associated with Modern Engineering Tools such as Lasers and Fiber Optics
- Evaluate characteristics of magnetic, dielectric and semiconducting material devices

LIST OF EXPERIMENTS
(Any Twelve Experiments are to be conducted)

1. Determination of Rigidity Modulus of the Material of Wire using Torsional Pendulum
2. Verification of Laws of Transverse vibrations in Stretched Strings using Sonometer
3. Wedge method – Determination of Thickness of Thin Object (hair
4. Determination of Numerical Aperture and Bending Loss of an Optical Fiber
5. Determination of Acceleration due to Gravity (g using Compound Pendulum
6. Determination of Energy Band Gap using the given Semiconductor Diode
7. Newton's Rings – Determination of the Radius of Curvature of given Convex Lens
8. Slit Width Determination with Single Slit Diffraction Phenomena using LASER
9. Determination of Thermal Coefficient using Thermistor
10. Determination of Wavelength of Monochromatic Source using LASER Diffraction
11. Determination of the Frequency of the given Tuning Fork using Volume Resonator
12. Study of the variation of Magnetic Field along the axis of a Circular Coil using Stewart and Gee's Method.
13. Diffraction Grating - Normal Incidence Method; Determination of Wavelength of given Source of Light using Spectrometer
14. Melde's Experiment – Determination of the Frequency of the Electrically Driven Tuning Fork
15. AC Sonometer – Determination of Frequency of AC Supply

MANUAL / RECORD BOOK:

1. Manual cum Record for Engineering Physics Lab, by Prof. M. Rama Rao, Acme Learning.
2. Lab Manual of Engineering Physics by Dr. Y. Aparna and Dr. K. Venkateswara Rao (VGS books links, Vijayawada

I Year B. Tech., II Semester

ENGLISH – II
(Common to all Branches)

Subject Code: 13HS1002 **Internal Marks: 30**
Credits: 2 **External Marks: 70**

COURSE OBJECTIVES:

- To improve the language proficiency of a technical under-graduate in English with emphasis on LSRW skills.
- To provide learning environment to practice listening, speaking, reading and writing skills.
- To assist the students to carry on the tasks and activities through guided instructions and materials.
- To effectively integrate English language learning with employability skills and training.
- To provide hands-on experience through case-studies, mini-projects, group and individual presentations.
- To expose the students to a variety of self-instructional modes of language learning.
- To develop learner autonomy.

COURSE OUTCOMES:

On completion of this course, students should be able to

- **Use** English language in their day-to-day life.
- **Employ** LSRW skills within and beyond the classroom environment.
- **Integrate** English Language Learning with employability skills.
- **Demonstrate** better with more observation and practice.
- **Relate** classroom language learning to the real life situations.
- **Interpret** things and draw **inferences** accordingly.

SYLLABUS:

UNIT – I

Globalization by Joseph Stiglitz
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

UNIT – II

My Early Days by Dr. A. P. J. Abdul Kalam
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

UNIT – III

I have a Dream by Martin Luther King
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

UNIT – IV

The Cop and the Anthem by O. Henry
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

UNIT – V

Telephone Conversation by Wole Soyinka
Reading – Vocabulary – Essential Grammar – Writing – Classroom activities.

TEXT BOOKS:

1. Preparing for the Future by Ed. D. Ravikumar et al., Maruti publishers
2. Wings of Fire – APJ Abdul Kalam

REFERENCE BOOKS:

1. Short Stories – O. Henry
2. 30 days to a more Powerful Vocabulary by Norman Lewis and Wilfred Funk.

ENVIRONMENTAL STUDIES
(Common to all Branches)

Subject Code: 13HS1003 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- Memorize the overall knowledge of the environment; differentiate the resources, reserves, importance and conservation.
- Identify the significance, arrangement, causes of annihilation of ecosystems and biodiversity; recognize the importance of their protection and preservation.
- Discriminate various causes, effects of a range of environmental pollutions and describe the appropriate control methods.
- Identify the sustainable development; evaluate the different environmental management issues and environmental legal issues.
- Describe the variations in population growth, recognizes the human health problems and evaluate the environmental assets.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Recognize the general issues of environment and know how to conserve the environment, speaks better on the structural issues and list out the resources, present status and their better usage.
- Explain the interdependency of life in the ecosystem, demonstrate the structural and functional setup, classify and appraise the importance of diversity on the earth and differentiate the conservation methods.
- Examine the various types of pollutants and their impacts along with their control methods; review the different types of solid wastes, impacts and their ecofriendly disposal methods.
- Translate the concept of sustainable development by green technologies, experiment on the environmental management systems for clean, green, safe and healthy environment through clean development mechanisms.
- Evaluate the changing trends of population curves among different nations, discuss how to limit the current population size, collect and compile the information to document the environmental assets.

UNIT – I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness. Environmental components – Atmosphere – Hydrosphere – Lithosphere – Biosphere.

Natural Resources: Resources classification – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems on Tribal population & Environment - Mineral resources: Use and exploitation, Tribal & environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity – concept of sustainable agricultural methods, case studies. – Energy resources: Growing energy needs, non-renewable energy sources - coal, crude oil, natural gas - use of renewable and alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.

UNIT – II

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. Food chains, food webs and ecological pyramids. - Energy flow and nutrient flow in the ecosystems - Ecological succession - Introduction, types, characteristic features, structure and function of the following ecosystem:

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

Biodiversity and its conservation: Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife - Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Case studies.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of :
a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban, Industrial and bio-medical wastes. - Pollution case studies. Role of individual in prevention of pollution - Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues and the Environment: Concept of Unsustainable and Sustainable development – Urbanization and Urban problems related to energy -Water conservation, rain water harvesting, watershed management -Resettlement and rehabilitation of people; its problems and concerns. Case Studies - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. - World summits on environment. -Wasteland reclamation. -EIA methodologies. – Environment Protection Act. -Air (Prevention and Control of Pollution Act. –Water (Prevention and control of Pollution Act - Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation.

UNIT – V

Human Population and the Environment: Population growth, variation among nations. Population problems and control -Environment and human health. Role of information Technology in Environment and human health. – Case Studies.

Field work: Visit to a local area to document environmental assets River / forest / grassland/hill/mountain - Visit to a local polluted site Urban/Rural/industrial/ Agricultural - Study of common plants, insects, birds. - Study of simple ecosystems pond, river, hill slopes, etc.

TEXT BOOKS:

1. Bharucha, E. 2005, Text book of Environmental Studies, First edition, Universities Press (India Pvt., Ltd., Hyderabad.
2. Dr. S. Keerthinarayana & Dr. C. Daniel Yesudian. 2004, Principles of Environmental Science and Engineering, First edition, Anuradha Publications (P Ltd., Kumbakonam.
3. P. Anandan & R. Kumaravelan. 2010, Environmental Science & Engineering, Sixth reprint, Scitech Publications (India (P Ltd., Chennai.
4. Anubha Kaushik & C. P. Kaushik. 2011, Environmental Studies, Third edition, New Age International (P Ltd., New Delhi.
5. Dr. Surinder Deswal & Dr. Anupama Deswal. 2008-09, A Basic Course in Environmental Studies, Second revised edition, Dhanpat Rai & Co (P Ltd., New Delhi.

REFERENCE BOOKS:

1. Odum, E.P. 1971, Fundamentals of Ecology, Third edition, W.B. Saunders & Co (P Ltd., Philadelphia.
2. P.D. Sharma. 1996, Ecology and Environment, Revised edition, Rastogi Publications (P Ltd.,
3. Cunningham, W.P., Cunningham, M.A., Principles of Environmental Science. TMH.
4. Peavy, Rowe and Tchobanoglous, Environmental Engineering, Mc Graw – Hill International edition.
5. Dr. Suresh K. Dhameja. 2006-07, Environmental Studies, Third revised edition, S.K. Kataria & Sons (P Ltd., New Delhi.
6. Graedel, T.E., Allenby, B.R., Industrial Ecology and Sustainable Engineering, Pearson Publications.

I Year B. Tech., II Semester

ENGINEERING MATHEMATICS – III
(Common to all Branches)

Subject Code: 13BS1003 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- Calculate the rank of a matrix, solve linear system of equations by different methods and apply the knowledge to find the current in an electric circuit.
- Understand the concept of eigen values, eigen vectors, Cayley's Hamilton theorem and its applications. Also to acquire the knowledge of reduction of quadratic to canonical form and its applications.
- Determine the Fourier series expansion, half range series of different functions in different intervals, Fourier & Inverse Fourier transforms of different functions and apply the same to solve problems.
- Acquire the knowledge of Z- transforms and inverse Z-transforms of different functions, study their properties and solve difference equations.
- Study the Beta and Gamma functions, their properties and apply to solve improper integrals..

COURSE OUTCOMES:
On completion of this course, students should be able to

- Can calculate the rank of a matrix, solve a linear system of equations and apply the knowledge to calculate the current in a electrical circuit.
- Can calculate the eigen values, eigen vectors, use Cayley's Hamilton theorem to calculate inverse and powers of a matrix. Reduce a quadratic form to canonical form and find its nature and calculate solution of free vibration of two mass systems.
- Can find the Fourier series, half range series expansion of different functions in different intervals, Fourier & inverse Fourier transforms of different functions and apply to solve definite integrals.
- Can calculate the z- transforms and inverse z-transforms of different functions and apply the same to solve the difference equations.
- Can apply Beta and Gamma functions to solve improper integrals.

UNIT – I
Matrices:
Rank of Matrix- Echelon form, Normal form – Solution of Linear System of equations – Direct methods, Gauss elimination, Gauss Jordan and Gauss Seidal Methods.
Applications: Finding the current in an electrical circuit.

UNIT – II
Eigen values - Eigen vectors – Properties – Cayley -Hamilton Theorem - Inverse and powers of a matrix by using Cayley-Hamilton theorem
Quadratic forms- Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - index – signature.
Applications: Free vibration of a two mass system.

UNIT – III

Fourier series and Fourier Transforms:

Fourier series: Determination of Fourier coefficients (without proof – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series.

Fourier integral theorem (only statement – Fourier sine and cosine integrals - Fourier transform – sine and cosine transforms – properties – inverse Fourier transforms – Finite Fourier transforms.

UNIT – IV

Z- Transforms:

Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems -Inverse z-transform – Partial fractions, Convolution theorem.

Application: Solution of Difference equations by Z-transforms.

UNIT – V

Special functions:

Gamma and Beta Functions – Properties - Relation between Beta and Gamma functions- Evaluation of improper integrals.

Application: Evaluation of integrals

TEXT BOOKS:

1. Higher Engineering Mathematics, 42nd edition, 2012 - B. S. Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics Volume - II, 6th editions respt., 2012, T.K.V Iyengar, & others, S.Chand Co. New Delhi.

REFERENCE BOOKS:

1. Mathematical Methods, 4th edition, 2009, B.V Ramana, Tata McGraw Hill, New Delhi.
2. Ravindranath, V. and Vijayalaxmi, A., 2nd edition, 2012, A Text Book on Mathematical Methods, Himalaya Publishing House, Bombay.
3. Dean G. Duffy, Advanced engineering mathematics with MatLab, CRC Press.
4. Advanced Engineering Mathematics, 8th edition, 2009, Erwin Kreyszig- Shree Maitrey Printech Pvt.Ltd, Noida.

BASIC ELECTRICAL AND ELECTRONICS
(Common to Civil, Mech. Branches)

Subject Code: 13EE1002 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide students basic practical knowledge of electric devices and components.
- To provide students knowledge about DC and AC machines.
- To provide students knowledge about Instruments.
- To make students learn the characteristics of devices like PN junction diode

COURSE OUTCOMES:

On completion of this course, students should be able to

- Solve simple electrical DC and AC circuits involving using Ohm's law, Kirchhoff's law.
- Explain principle of operation, construction, governing equations, various losses, efficiency, testing of DC machines.
- Describe principle of operation, emf equation, losses, efficiency and regulation of single phase transformers, alternator and induction motor.
- Explain basic principles of different electrical measuring instruments. Understand the operation of moving coil and moving iron instruments.
- Explain the basic characteristics of a diode, its use as a half-wave and full-wave rectifier. Understand PNP and NPN transistor, their SCR characteristics and its use as an amplifier.

UNIT-I

ELECTRICAL CIRCUITS

Basic definitions, Types of elements, Ohm's Law, elements R, L and C their V-I relationships & symbols, Resistive networks, Kirchhoff's Laws, Inductive networks, Capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations, simple problems.

UNIT II

DC MACHINES

Principle of operation of DC Generator, construction, emf equation, types & characteristics of DC generators, Principle of operation of DC motor, types, torque equation , characteristics losses, efficiency, testing of DC motors, applications, three point starter.

UNIT III

TRANSFORMER & AC MACHINES

Principle of operation of single phase transformer, emf equation, losses, efficiency and regulation. Principle of operation of alternator, emf equation, regulation by synchronous impedance method. Principle of operation of induction motor, speed, slip-torque characteristics, applications.

UNIT IV

INSTRUMENTS

Basic Principle of indicating instruments, types of instruments, operation of permanent magnet moving coil and moving iron instruments.

UNIT V

DIODE AND TRANSISTOR CHARACTERISTICS

P-N junction diode, symbol, V-I Characteristics, Diode Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers(simple Problems). P-N-P and N-P-N Junction transistor, Transistor as an amplifier, SCR characteristics and applications.

TEXT BOOKS:

1. Essentials of Electrical and Computer Engineering by David V. Kerns, JR. J. David Irwin
2. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand& Co.

REFERENCE BOOKS:

1. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.
2. Basic Electrical Engineering – Dr. K. B. Madhu Sahu, Scietech Publications

I Year B. Tech., II Semester

CLASSICAL MECHANICS
(Only for Mech. Branch)

Subject Code: 13ME1002 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide knowledge on system of forces, free body diagram.
- To provide knowledge on friction between two matting surfaces.
- To provide knowledge on centre of gravity and moment of inertia for different sections.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Draw free-body diagrams and solve statics problems using resultant force, moment about a point, and equations of equilibrium.
- Determine forces within plane trusses using method of joints and method of sections. Apply principle of virtual work to determine forces, deflections and stability of simple structures.
- Determine centroid, area and mass moment of inertia of simple and composite 2D and 3D bodies.
- Calculate velocities and accelerations of a particle having rectilinear or curvilinear motion.
- Apply Work-energy method, impulse-momentum method, D'Alemberts principle in determining rigid body kinetics for both translational and rotational motion.

UNIT – I

Introduction to Engineering. 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.

Equilibrium of Systems of Forces : Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, 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.

UNIT – II

Analysis of perfect Trusses – Assumptions for forces in members of a perfect truss, Method of joints, Method of sections, Force table, Cantilever Trusses, Structures with one end hinged and the other freely supported on rollers carrying horizontal or inclined loads.

Principle of virtual work – equilibrium of ideal systems

UNIT – III

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

Centre of Gravity: Centre of gravity of simple body (from basis principles, centre of gravity of composite bodies, pappus theorem.

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-IV

Kinematics: Rectilinear and Curvelinear 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

UNITV

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

Curvilinear translation- Kinematics- equation of motion- projectile- D'Alemberts Principle in curvilinear motion, Moment of momentum, Work- Energy in curvilinear motion. Kinetics of Rotation of rigid body.

TEXT BOOKS:

1. Engineering Mechanics / Irving. H. Shames Prentice – Hall.
2. Engineering Mechanics / S.S. Bhavikati & J.G. Rajasekharappa

REFERENCE BOOKS:

1. Engineering Mechanics / Fedinand . L. Singer / Harper – Collins.
2. Engineering Mechanics / Timoshenko & Yound.
3. Engineering Mechanics Umesh Regl / Tayal.
4. Engineering Mechanics / R.V. Kulkarni & R.D. Askhevkar
5. Engineering Mechanics/Khurmi/S.Chand.
6. Engineering Mechanics / KL Kumar / Tata McGraw Hill.

I Year B. Tech., II Semester

ENGINEERING CHEMISTRY
(Common to all Branches)

Subject Code: 13BS1005 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To become familiar in moulding methods of preparation of different types of plastic materials.
- To understand the determination of hardness of water sample by EDTA method.
- To understand the methods of prevention of corrosion of metal.
- To become familiar about different lubricantion techniques.
- To understand about constructing the PV cell.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Differentiate different moulding techniques of plastic materials.
- Determine total hardness of water by EDTA method.
- Design the metallic materials to prevent corrosion.
- Apply suitable lubrication mechanisms for various machinery parts.
- Demonstrate the working of PV cell.

UNIT-I:

POLYMERS:

Polymerization reactions – Basic concepts, types of polymerisation – addition and condensation polymerisations, plastics – thermosetting and thermoplastics – differences.Compounding and Moulding of plastics – Compression, injection, transfer and extrusion moulding methods. Preparation, properties and engineering uses of the following: PE, PVC, Teflon, Bakelite, Nylon, Polyesters.

BUILDING MATERIALS: Cement – Classification; Portland cement – raw materials, manufacture of Portland cement, chemical constitution of Portland cement, Setting and Hardening of Portland Cement.

UNIT-II:

WATER TECHNOLOGY:

Introduction – Hardness of Water – Temporary and Permanent hardness, Units and inter conversions of Units. Estimation of hardness by EDTA Methods.Problems on Temporary and Permanent hardnesses. Disadvantages of Hard Water, Methods of Treatment of Water for Domestic Purposes – Sedimentation, Coagulation, Filtration, Disinfection – Sterilization, Chlorination, Break Point chlorination, Ozonisation – Industrial Water Treatment – Desalination, Reverse Osmosis Treatment - Lime-Soda Process, Zeolite Process, Ion-Exchange Process.

UNIT-III:

SCIENCE OF CORROSION:

Definition, examples, Types of corrosion: Theories of corrosion and Mechanism – Dry corrosion (Direct chemical attack, Wet corrosion (Electrochemical theory Principles of corrosion, Galvanic series, Galvanic corrosion, Concentration cell corrosion, mechanism of wet corrosion – Hydrogen evolution type, oxygen absorption type. Factors influencing corrosion control of corrosion – proper design, use of pure metal and metal alloys, passivity, cathodic protection – Sacrificial anode and impressed current. Modifying the environment, use of inhibitors.

UNIT-IV:

FUEL TECHNOLOGY:

Introduction to Liquid Fuels-Classification of Crude Oil-Fractional Distillation-Cracking (Thermal &Catalytic, Synthetic Petrol (Fischer-Tropschs & Bergius Process - Polymerization-Refining &Reforming – Knocking –Anti Knocking Agents-Octane & Cetane Number.

LUBRICANTS:

Principle and functions of lubricants – Types of lubrication and mechanism – Thick film or Hydrodynamic lubrication, Thin film lubrication, extreme pressure lubrication. Classification and properties of lubricants – Viscosity, flash and fire points, cloud and pour points, aniline points, neutralization number and mechanical strength.

UNIT-V:

SOLAR ENERGY:

Introduction – harnessing solar energy – photo voltaic cells – Concentrated Solar Power Plants – green house concepts.

GREEN CHEMISTRY:

Introduction-12 principles of green chemistry – green synthesis - Engineering Applications

NANO CHEMISTRY:

Introduction to Nano materials-preparation of few Nano materials (Carbon Nano Tubes,Fullerenes etc- Top down and Bottom up concepts - Properties of Nano materials- Silver and Gold Nano particles - Engineering & Biomedical applications.

TEXT BOOKS:

1. "Engineering Chemistry", P.C.Jain and Monica Jain, DhanpatRai Publications, Co., New Delhi 15th Edition.
2. "A Text Book of Engineering Chemistry", S.S. Dara, S.S.Umare, S.Chand& Co., Ltd., 12th Edition.

REFERENCE BOOKS:

1. "A Text Book of Engineering Chemistry" by Dr.Sunita Rattan, S.K. Kataria& Sons (2012.
2. "A Text Book of Engineering Chemistry", by S. Nagarajan, R. Gopalan, D.Venkatappayya, 3rd edition, Vikas Publishing House.
3. "Engineering Chemistry" by Wiley India Editorial Team, Wiley Publishers (2011.
4. "A Text Book of Nano Science and Nano technology", by T. Pradeep, Tata Mc.Graw Hills (2012.

BASIC ENGLISH LANGUAGE COMMUNICATIONS SKILLS LAB
(Common to all Branches)

Subject Code: 13HS1101 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To improve the communication skills through Listening & Practicing the structures of language.
- To make the students to adopt themselves to the situations and converse using their spontaneity.
- To make the students acquiring the language proficiency.
- To provide the real life situations to emulate the language properly.
- To make them realize the importance of Stress, Intonation and Rhythm of language.
- To make the students to improve pronunciation, vocabulary, language skills, communication skills, body language and grammar to fulfill the demands of the employer.

COURSE OUTCOMES:

On completion of this course, students should be able to

- **Transform** themselves into effective speakers of English.
- Emulate the language properly and **relate** it to the real life situations.
- Acquire and make **use** of LSRW skills rather productively.
- **Point out** stress on the words and apply rhythm in their speech.
- **Apply** know-how of vocabulary efficiently depending on the context words are used in.

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List of Sessions

Unit – I: Introduction to Phonetics, Sentences and its applications and listening skills.

Unit – II: Consonant Sounds, Parts of Speech & Speaking skills.

Unit – III: Vowel Sounds, Tenses & Writing skills.

Unit – IV: Syllable & Stress, voice & Writing skills.

Unit – V: Rhythm & Intonation, Reported Speech & Situational Dialogues.

TEXT BOOKS:

1. "Speak Well" by K. Nirupa Rani, Jayashree Mohan Raj, B. Indira, Orient Blackswan, Hyderabad (2012
2. "Strengthen your Steps" by Dr. M. Hari Prasad, Dr. John Varghese, Dr. R. Kishore Kumar, Maruthi Publications, Hyderabad (2010

REFERENCES BOOKS:

1. A Text Book of English Phonetics: For Indian Students by T. Balasubramanian, Macmillan Publishers India (2000
2. Better English pronunciation by J.D. O'Connor, Cambridge Unviersity Press, 23-Oct- 1980. Practical English Usage by Michael Swan.

I Year B. Tech., II Semester

ENGINEERING CHEMISTRY LAB
(Common to all branches)

Subject Code: 13BS1102 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:
The students completing this course are expected to understand:

- To understand the determination of D.O., Turbidity of water sample.
- To become familiar about the determination of viscosity, flash point and acid value of oil.
- To learn concepts about the pH and conductometric titrations.
- To understand the determination of hardness of water sample by EDTA method.
- To become familiar about all the instruments in the chemistry laboratories.

COURSE OUTCOMES:
On completion of this course, students should be able to

- Determine D.O., Turbidity etc of water sample.
- Can explain the importance of viscosity, Flash point and Acid value of a lubricant.
- Determine the amount of acid or base by pHmetric and conductometric titrations.
- Have the capacity to determine the hardness of various water samples.
- Operate all the instruments in the chemistry laboratory.

LIST OF EXPERIMENTS

(Any Twelve Experiments are to be conducted

1 Determine the Acid Value present in the given lubricating oil.
2 Determine the Flash and Fire points of given Oil Sample.
3 Determine the Kinematic Viscosity of a given oil sample by using Viscometer.
4 Estimate the amount of Dissolved Oxygen present in the given water sample by Modern Winkler's Method.
5 Determine the Total Hardness present in the given water sample by using EDTA Method.
6 Estimate the amount of Turbidity present in the given water sample by using Turbidity meter.
7 Estimate the Viscosity of an Organic Solvent by using Ostwald Viscometer.
8 Prepare Phenol-Formaldehyde Resin and calculate its weight.
9 pH metric Titrations between Strong acid and Strong base.
10 pH metric Titrations between Strong acid and Weak base.
11 Conductometric Titrations between Strong acid and strong base.
12 Conductometric Titrations between Strong acid and Weak base.
13 Colorimetric estimation of Iron (III.
14 Estimate the amount of Calcium present in given cement sample.

TEXT BOOKS:

1. Practical Engineering Chemistry by K.Mukkanti, etal. B.S.Publications, Hyderabad (2011
2. "Lab Manual on Engineering Chemistry" by Dr.Sudharani, DhanpatRai Publications, Co., New Delhi. (2010

REFERENCE BOOKS:

1. Engineering Chemistry Lab Manual: SCITECH, ShuchiTiwari (2010
2. "Vogel Text Book of Quantitative Chemical Analysis", 6th Edition by G.J.Jeffery, J.Bassett, J.Mendham, R.C. Denney, Longman Scientific & Technical Publications, Newyork.
3. "A Text Book of Engineering Chemistry" by R.N.Goyal and HarmendraGoel, Ane Books, India.
4. "A Text Book on experiments and calculations Engineering, S.S. Dara", S.Chand& Co., Ltd., (2003
5. Instrumental methods of Chemical Analysis, Chatwal, Anand, 5th Edition, Himalaya Publications.

INFORMATION TECHNOLOGY WORKSHOP LAB
(Common to all Branches)

Subject Code: 13CS1103 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- 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.
- All the DOS commands would be covered for maintains of the Operating system.
- Internet & World Wide Web module introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet. Usage of web browsers, email, newsgroups and discussion forums would be covered.
- Productivity tools module would enable the students in crafting professional word documents, excel spread sheets, power point presentations and personal web sites using the Microsoft suite of office tools.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Gain knowledge on computer system such as system Unit, input devices, and output devices connected to the computer.
- Gain knowledge to understand the booting process that includes switching on the system, and familiar with all the commands of an operating system.
- Gain knowledge to understand the working of the internet that include the use of protocols, domains, IP addresses, URLs, web browsers and search engines etc.
- Get familiarize with parts of Word window, To create and save a document, To set page settings, create headers and footers, To use various formatting features such as bold face, italicize, underline, subscript, superscript, line spacing, etc.
- Get familiarize with parts of Excel window, to create and save a workbook with single and/or multiple worksheets, to apply operations on range of cells using built-in formulae, etc.
- Get familiarize with parts of PowerPoint win, to create and save a new presentation, apply design templates to a presentation, to insert, edit and delete a slide , etc.

PC Hardware

Task 1: Identification of the peripherals of a computer.
To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions.

Task 2: (Optional) : A practice on disassemble the components of a PC and assembling them to working condition.

Task 3 : Installation of WINDOW XP operating system in PC.

Task 4: Introduction to all internal and external DOS commands

Task 5 : Installation of LINUX operating system in PC.

Internet & World Wide Web

Task 6: S**urfing the Web using Web Browsers and Search engine:** How to access the websites and email. Students customize their web browsers using bookmarks, search toolbars and pop up blockers. And Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google.

MS – Word

Word Orientation : Describe Importance of MS- Word

Task 7 :Using word to create project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.

Task 8: Creating project abstract for using MS-WORD: Abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check , Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs.

Task 9 : Creating a Newsletter : Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs

Task 10 : Creating a Feedback form - Features to be covered- Forms, Text Fields, Inserting objects, Mail Merge in Word.

MS-Excel

Excel Orientation : The mentor needs to tell the importance of MS/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources

Task 11 : Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 12 : Creating Performance Analysis - Features to be covered:- Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

Task 13: Calculating GPA - Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

Task 14: Creating Cricket Score Card - Features to be covered:-Pivot Tables, Interactive Buttons, Importing Data, Data Protection, Data Validation

MS-Power Point

Task 15 : Students will be working on basic power point utilities and tools which help them create basic power point presentation.
Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting –Images, Clip Art, Tables and Charts in Powerpoint.

Task 16 : Concentrating on the in and out of Microsoft power point, Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides.

TEXT BOOKS:

1. Vikas Gupta ,“Comdex Information Technology course tool kit” , WILEY Dreamtech
2. Cheryl A Schmidt ,“The Complete Computer upgrade and repair book”, 3rd edition, WILEY Dreamtech
3.“Introduction to Information Technology”, ITL Education Solutions limited, Pearson Education.
4. Kate J. Chase ,“PC Hardware and A+ Handbook” –PHI (Microsoft)

REFERENCE BOOKS:

1 Scott. Mueller, 2008, Upgrading and Repairing PCs, 18/e, QUE, Pearson,
2 Cheryl A Schmidt ,The Complete Computer upgrade and repair book,3/e , Dreamtech

ELECTRICAL AND ELECTRONIC ENGINEERING LAB
(Common to Civil, Mech. Branches)

Subject Code: 13EE1102 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To understand the working of different DC machines, AC Machines, Transformers and their performance characteristics with the help of suitable tests.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Determine the efficiency of a DC Shunt machine using Swinburne's test, and 1-Φ transformer using OC & SC tests.
- Find performance characteristics of a 3-Φ induction motor. Regulate an alternator using synchronous impedance method.
- Conduct speed control test and brake test on a DC shunt motor.
- Determine transistor and amplifier CE input and output characteristics.
- Conduct performance test on full-wave rectifier and RC phase shift oscillator.

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's test on D.C. Shunt machine. (Predetermination of efficiency of a given D.C. Shunt machine working as motor and generator.
2. OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors)
3. Brake test on 3-phase Induction motor (Determination of performance characteristics)
4. Regulation of alternator by Synchronous impedance method.
5. Brake test on D.C Shunt Motor
6. Transistor CE Characteristics (Input and Output
7. Full wave Rectifier with and without filters.
8. CE Amplifiers.

Additional Experiments:

9. RC Phase Shift Oscillator
10. Class a Power Amplifier
11. Micro Processor

COMPLEX VARIABLES & STATISTICAL METHODS

Subject Code: 13BS2007 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- Test if a function is analytic, harmonic and then find a harmonic conjugate via the Cauchy-Riemann equations, evaluate contour integrals.
- Identify and classify zeros and singular points of functions, calculate the residues by Laurent Series & residue theorem. Also, apply residue theorem to evaluate various contour integrals.
- Find the images of different complex functions and mapping from z-plane to w-plane and determine the bilinear transformations.
- Apply Baye's theorem to solve industry related problems, understand the properties of Discrete and Continuous distributions.
- Calculate the characteristics of probability distribution under different conditions using Binomial, Poisson and Normal. Also, define the hypothesis, identify appropriate test and apply in a range of statistical test.. .

COURSE OUTCOMES:

On completion of this course, students should be able to

- Can identify an analytic function, harmonic function, find harmonic conjugate function via Cauchy-Riemann equations, evaluate contour integrals using the Cauchy Integral Theorem.
- Can identify and classify zeros and singular points of functions, calculate the residues by Laurent Series & residue theorem. Also, apply residue theorem to evaluate various contour integrals.
- Can find the images of different complex functions and mapping from z-plane to w-plane and determine the bilinear transformations.
- Can apply Baye's theorem to solve industry related problems, understand the properties of Discrete and Continuous distributions.
- Can identify here to use the certain standard probability distributions. Also, define the hypothesis, identify appropriate test and apply in a range of statistical test.

UNIT-I

ANALYTIC FUNCTIONS AND INTEGRATIONS:

Functions of a complex variable – Continuity, differentiability, analyticity properties – Cauchy-Reimann equations in cartesian and polar coordinates (without proof – Harmonic and conjugate harmonic functions, Milne-Thompson method – Cauchy's integral theorem, Cauchy's integral formula, Generalized Cauchy's integral formula.

UNIT-II

INTEGRATION USING RESIDUES:

Singular point, isolated singular point, pole of order m, essential singularity – Residue, Evaluation of residue by formula and by Laurent series, Residue theorem – Evaluations of integrals of the type

(a Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b $\int_{C}^{C+2®} f(\cos^{-},\sin^{-})d^{-}$ (c $\int_{-\infty}^{\infty} e^{imx} f(x)dx$ (d Integrals by indentation.

UNIT-III

CONFORMAL MAPPING:

Conformal mapping – Transformation by e^z , lnz, z^2, z^n (n is positive integer, Sinz, Cosz, z+a/z –Translation, rotation, inversion and bilinear transformation – Fixed point, cross ratio, properties – Invariance of circles and cross ratio – Determination of bilinear transformation mapping of 3 given points.

UNIT-IV

PROBABILITY AND DISTRIBUTIONS:

Conditional Probability, Baye's theorem – Random variables and Expectations – Binomial, Poisson, Normal distributions and related properties – Moment generating function and its properties.

UNIT-V

SAMPLING DISTRIBUTIONS AND TEST OF HYPOTHESIS:

Population and samples, sampling distribution of mean (with known and unknown variance proportions, variances – Sampling distribution of sums and differences (no derivations.

Statistical Hypothesis: Type-I and Type-II errors and their calculations – One tail, two tail tests – Test of hypothesis concerning means, proportions and their differences using z-test, Student's t-, F- and χ^2- tests.

TEXT BOOKS:

1. Engineering Mathematics Vol-III, T.K.V. Iyengar, B.Krishna Gandhi, M.V.S.S.N. Prasad, S. Ranganatham, S. Chand Pub.
2. Probability and Statistics for Engineers, John E. Freund, Richard Arnold Johnson, Irwin Miller, Prentice Hall India Pub.
3. Higher Engineering Mathematics B.S.Grewal, Khanna Pub.

REFERENCES BOOKS:

1. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pub.
2. Probability and Statistics, Athanasios Papoulis, Prentice Hall India Pub.

MECHANICS OF SOLIDS

Subject Code: 13ME2004 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To gain fundamental understanding of the concepts of stress and strain by analysis of solids and structures.
- To study engineering properties of materials, force-deformation, and stress-strain relationship.
- To understand shear force and bending moment diagrams.
- To understand shear stresses and bending stresses.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Compute normal, shear, principle stresses and strain energy of components subjected to external forces and temperature changes.
- Compute shear force and bending moments for statically determinate cantilever or simply-supported beams subjected to various loads.
- Determine flexural stresses and deformations using bending formula, and shear stresses and deformations using shear formula.
- Compute beam deflections using double integration, Macaulay and moment-area methods.
- Calculate longitudinal, hoop and radial stresses for thin and thick, simple and compound cylinders subjected to both internal and external pressures.

UNIT-I

SIMPLE STRESSES & STRAINS:

Elasticity and plasticity, Types of stresses and strains, Hooke's law, Stress-strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio, Volumetric strain, Elastic moduli and relationship between them – Bars of varying section – Composite bars – Temperature stresses – Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

PRINCIPAL STRESSES & STRAINS:

Compound stresses, Analysis of principal planes and principal stresses, Principal strains, Angle of obliquity of resultant stress, Principal stresses in beams.

UNIT-II

SHEAR FORCE AND BENDING MOMENT:

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

UNIT-III

FLEXURAL STRESS:

Theory of simple bending, Assumptions – Derivation of bending equation $M/I = \sigma/y = E/R$, Neutral axis – Determination bending stresses – Section modulus of rectangular and circular sections (solid and hollow, I, T, angle, channel sections – Design of simple beam sections.

SHEAR STRESS AND TORSION:

Derivation of shear formula – Shear stress distribution across various cross sections like rectangular, circular, triangular, I & T – Stresses and deformation in circular (solid and hollow shafts – Stepped shafts – Shafts fixed at both ends.

UNIT-IV

DEFLECTION OF BEAMS:

Bending into a circular arc – Slope, deflection and radius of curvature, Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads and uniformly varying loads – Moment area method, application to simple cases including overhanging beams.

UNIT-V

THIN CYLINDERS:

Thin seamless cylindrical shells – Derivation for longitudinal and circumferential stresses – Hoop, longitudinal and volumetric strains, changes in diameter and volume of thin cylinders – Riveted boiler shells – Thin spherical shells – Wire wound cylinders.

THICK CYLINDERS:

Lame's equation – Cylinders subjected to inside and outside pressures – Compound cylinders.

TEXT BOOKS:

1. Strength of Materials, S.S. Rattan, Tata McGraw Hill Pub.
2. Strength of Materials, R.K. Rajput, S. Chand Pub.

REFERENCES:

1. Strength of Materials, S.S. Bhavikatti, Lakshmi Pub.
2. Analysis of Structures Vol-I, Vazirani, Ratwani, Khanna Pub.
3. Mechanics of Materials, Ferdinand Beer, E. Russell Johnston, John DeWolf, David Mazurek, Tata McGraw Hill Pub.
4. Engineering Mechanics of Solids, Egor P. Popov, Prentice Hall India Pub.

II Year B. Tech., I Semester

PRODUCTION TECHNOLOGY

Subject Code: 13ME2005 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand different manufacturing processes.
- To understand fundamental concepts related to forging and other mechanical working processes.
- To understand various tools, equipment and processes used in pattern making, mold and core making and foundry shop.
- To learn necessary details of various welding and allied joining processes such as gas welding, arc welding, resistance welding, brazing and soldering.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Outline functions, types and design considerations of various elements of casting process including patterns, molding materials especially of sand, gating, riser, runner and melting furnaces.
- Comprehend the working of different welding processes including arc, gas, resistance and other weldings, along with their subtypes of welding.
- Calculate rolling process parameters, and understand both forming and rolling processes.
- Explain principles of various kinds of extrusion, drawing, forging and sheet metal working processes.
- Explain various high velocity forming processes and plastic injection and blow molding processes.

UNIT-I

FOUNDRY:

Fundamentals, Introduction to casting process, Process steps, Advantages, Applications, Pattern types and pattern allowances – Molding materials, Importance of constituents, Molding tools and equipment.

MOLDING PROCESSES:

Sand molding types: Green, Dry, Skin Dried, Loam sands – CO_2 molding – Shell molding.

GATING & RISERING:

Gating system, Elements of gating system, Runner design, Calculation of gating system dimensions for simple objects. Riser system, Riser design, Design considerations in casting.

MELTING & CASTING:

Melting furnaces, Crucible furnace, Cupola, Solidification of casting, Casting defects, Remedies.

UNIT-II

JOINING:

Fundamentals, Classification of welding processes, Types of welds, Types of joints.

ARC WELDING:

Equipment, Electrodes, Principle of arc, Mode of metal transfer, Shielded metal arc welding, Submerged arc welding, Plasma arc welding, Tungsten Inert Gas welding (TIG, Metal Inert Gas (MIG welding.

GAS WELDING:

Equipment, Oxy-Acetylene flame, types, gas welding procedure, Oxygen-Hydrogen welding, Gas cutting.

RESISTANCE WELDING:

Principle, Spot welding, Seam welding, Projection welding.

OTHER WELDING PROCESS:
Friction welding, Laser beam welding, Thermit welding. Brazing, Braze welding, Soldering, Weld Defects.

UNIT-III
FORMING:
Fundamentals, Introduction to metal working process, Hot working, Cold working.

ROLLING:
Rolling fundamentals, Analysis of rolling process, Rolling stand arrangements, Rolling passes.

UNIT-IV
EXTRUSION & DRAWING:
Extrusion fundamentals, Classification of extrusion, Wire drawing, Tube drawing, Impact extrusion, Hydrostatic extrusion.

FORGING:
Fundamentals, Forging, Die forging, Roll forging, Press forging, Upset forging.

SHEET METAL WORKING:
Principles of sheet metal working, Spring back and shearing. Types of Dies, Drawing, Bending, Punching, Blanking, Spinning, Coining.

UNIT-V
HIGH VELOCITY FORMING:
Explosive forming, Electro hydraulic forming, Magnetic pulse forming, Pneumatic – Mechanical high velocity forming.

PLASTICS PROCESSING:
Types of plastics, Plastic molding processes.

TEXT BOOKS:
1. Manufacturing Technology Vol-I, P.N. Rao, Tata McGraw Hill Pub.
2. Production Technology, P.C.Sharma, S.Chand Pub.

REFERENCES BOOKS:
1. Production Technology, R.K. Jain, Khanna Pub.
2. Elements of Workshop Technology Vol-II, S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, Media Promoters Pub.
3. Production Technology, Hindustan Machine Tools Pub.
4. Workshop Technology Vol - II, W.A.J. Chapman, Oxford Pub.

ENGINEERING METALLURGY AND MATERIAL SCIENCE

Subject Code: 13ME2006 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand different engineering materials and their structures.
- To understand the phase diagrams.
- To understand the powder metallurgy processes.
- To understand various heat treatment processes.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Summarize various crystal imperfections, calculate packing density, and know about constitution of alloys.
- Identify various zones in iron-carbon phase diagram and structural modification during phase transformations.
- Classify various steels, cast irons and non-ferrous alloys, and state their properties and applications.
- Explain various testing procedures for determining mechanical properties like tensile test, hardness tests, impact tests, fracture, fatigue and creep tests.
- Outline various considerations in designing powder metallurgy components including powder production methods and cold & hot compaction techniques.

UNIT-I

CRYSTAL SYSTEMS AND LATTICES:

Crystallography, Crystals and types, Miller indices for directions and planes, Voids in crystals, Packing density in crystals, Crystal imperfections: Point defects, Line defects, Surface defects – Characteristics of dislocations, generation of dislocations – Bonds in solids, Characteristics of metallic bonding – Deformation mechanisms and strengthening mechanisms in structural materials.

CONSTITUTION OF ALLOYS:

Solid solutions, substitutional and interstitial-intermediate alloy phases.

UNIT-II

PHASE DIAGRAMS:

Principles and various types of phase diagrams – Iron carbon phase diagrams.

PRINCIPLES OF SOLIDIFICATIONS:

Structural evaluation during solidification of metals and alloys.

UNIT-III

HEAT TREATMENT OF STEELS & TTT DIAGRAMS:

Pearlitic, Martensitic, Bianitic transformation in steel during heat treatment.

STEELS & NON-FERROUS ALLOYS:

Classifications, Properties and Applications of: Alloy steels, Tool steels, Stainless steels, Cast irons – Non-ferrous materials like copper base alloys, aluminum base alloys, Nickel base alloys, Titanium base alloys.

UNIT- IV

MECHANICAL PROPERTIES:

Properties evaluated by tensile testing procedure, Engineering stress-strain curve vs. true stress-strain curve, Stress-strain curve for typical materials – Hardness testing – Impact testing – Fracture, Toughness, Fatigue testing – Creep testing.

UNIT-V

POWDER METALLURGY:

Definition, Methods of production of metal powders, Processing of metal powders, Cold compaction and hot compaction techniques, Design considerations**.**

TEXT BOOKS:

1. Introduction to Physical Metallurgy, Sidney H. Avener, McGraw-Hill Pub.
2. Material Science and Metallurgy, V.D. Kodgire, Everest Pub.
3. Essentials of Materials Science & Engineering, Donald R.Askeland & Pradeep P.Fulay, Cengage Pub.

REFERENCES BOOKS:

1. Elements of Material Science, V. Raghavan, Prentice Hall India Pub.
2. Physical Metallurgy Principles, Reza Abbaschian, Lara Abbaschian, Robert Reed Hill, Cengage Pub.
3. Material Science and Engineering - An Introduction, William D. Callister, John Wiley Pub.

II Year B. Tech., I Semester

THERMODYNAMICS

Subject Code: 13ME2007 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To identify and formulate elementary level engineering problems related to thermodynamics and energy transformation in a conceptual form as well as in terms of mathematical and physical models.
- To apply the basic principles of classical thermodynamics to the analysis of processes and cycles involving pure simple substances.
- To effectively generalize the basic axioms of classical, macroscopic thermodynamic analysis and to extrapolate these concepts to systems and substances not necessarily covered in the course.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Apply basic concepts, zeroth law and first law to non-flow processes of thermodynamics.
- Apply steady flow energy equation to flow systems, and second law and entropy calculations to thermodynamic components.
- Calculate available and unavailable energies, determine irreversibility, and apply Maxwell's equations. Determine energy transferred using equations and Mollier charts for pure substances with phase transformation.
- Determine properties of mixtures from the properties of its constituents and composition. Calculate energy transfers in various psychrometric processes using psychrometric properties.
- Derive thermal efficiency and mean effective pressures for various thermodynamic cycles and compare their performances.

UNIT-I

INTRODUCTION AND ZEROTH LAW:

Introduction, Basic Concepts: System, Control volume, Surrounding, Boundaries, Types of systems, Macroscopic and microscopic view points, Concept of continuum, Thermodynamic equilibrium, State, Property, Process, Cycle: Reversible and Irreversible – Energy in state and transition, Work, Heat – Point function, Path unction – Zeroth Law of Thermodynamics – Concept of Temperature, Principles of Thermometry, Joule's Experiments.

FIRST LAW APPLIED TO NON-FLOW PROCESSES:

First law, Corollaries – First law applied to various non-flow processes – Change in Internal Energy – Systems undergoing a cycle and change of state – Throttling and free expansion.

UNIT-II

FIRST LAW APPLIED TO FLOW SYSTEMS:

Steady Flow Energy Equation – Limitations of First law.

SECOND LAW:

Second law – Kelvin Plank statement, Clausius statement, Their equivalence, Corollaries – Perpetual Motion Machines (PMM of first kind and second kind – Carnot Cycle – Heat Engines, Heat Pumps, Carnot Efficiency – Clausius theorem, Clausius inequality – Concept of entropy- Principle of increase of entropy, Entropy and disorder – Third Law.

UNIT-III

AVAILABILITY AND IRREVERSIBILITY:

Energy and available energy – Helmholtz function and Gibbs function – Availability in steady flow and non-flow processes – Entropy equation for flow process – Irreversibility and change of Entropy - Maxwell's Equations.

PURE SUBSTANCES:
Introduction, P-V-T surfaces, T-S & H-S diagrams, Mollier charts, Phase transformations – Triple point at critical state properties during change of phase, – Dryness fraction – Various thermodynamic processes and energy transfer.

UNIT-IV
GAS LAWS:
Perfect gas laws – Equation of state, Universal gas constant, Vander Waal's equation of state.

MIXTURES:
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 constant, Molecular internal energy, Enthalpy, Specific heats and entropy of mixture of perfect gases and vapor.

PSYCHROMETRY:
Atmospheric air – Definitions of psychrometric properties: Dry bulb temperature, Wet bulb temperature, Dew point temperature, Specific humidity, Relative humidity, Saturated air, Vapour pressure, Degree of saturation, Adiabatic saturation, Carrier's Equation.

UNIT-V
THERMODYNAMIC CYCLES:
Cycles: Otto, Diesel, Dual Combustion, Sterling, Atkinson, Ericcson, Lenoir – Description and representation on P–V and T-S diagram, Thermal efficiency, Mean effective pressures on air standard basis – Comparison of Cycles – Bell Coleman cycle, Vapour compression cycle, Performance cycles.

TEXT BOOKS:
1. Engineering Thermodynamics, P.K. Nag, Tata McGraw-Hill Pub.
2. Thermal Engineering, R.K. Rajput, S.Chand Pub.
3. Steam Tables & Mollier Charts. (**Permitted for Exam**
4. Refrigeration Tables & Charts. (**Permitted for Exam**

REFERENCES BOOKS:
1. Thermal Engineering, P.L. Ballaney, Khanna Pub.
2. Thermal Engineering, M.L.Mathur, F.S.Mehta, Jain Brothers Pub.
3. Introduction to Thermodynamics, J.B.Jones, G.A.Hawkins, John Wiley Pub.
4. Fundamentals of Thermodynamics, Gordon John Van Wylen, Richard Edwin Sonntag, John Wiley Pub.

II Year B. Tech., I Semester

METALLURGY / MOS LAB

Subject Code: 13ME2103 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To understand metallographic structures.
- To understand different material testing techniques.
- To find hardness, tension and compression strength of given specimens.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Determine metallographic structure for pure metals, cast irons, mild steels, alloys.
- Interpret effect of heat treatment on hardness of steels measured using Jominy End Quench Test.
- Test mechanical properties of given specimen using tension test, compression test, bending test, shear test on universal testing machine.
- Grade the specimen by conducting Izod and Charpy impact strength, Brinell and Rockwell hardness tests.
- Compute spring stiffness by measuring spring deformations for applied loads.

METALLURGY LAB

LIST OF EXPERIMENTS:

1. Preparation of any one specimen and metallographic observation of pure metals copper and aluminum.
2. Preparation of any one specimen and metallographic observation of white cast iron, grey cast iron, nodular iron.
3. Preparation of any one specimen and metallographic observation of mild steel, low carbon steel, medium carbon steel, high carbon steel and high speed steel.
4. Preparation of any one specimen and metallographic observation of Al-Si alloys, Al-Bronze alloy, Pb-Tin soldering alloy, Pb-Tin antimony alloy.
5. Verify the effect of heat treatment on hardness of steels.
6. Hardenability measurement by Jominy End Quench test.

MECHANICS OF SOLIDS LAB

LIST OF EXPERIMENTS:

1. Direct tension test.
2. Bending test on simply supported beam.
3. Torsion test.
4. Hardness tests:
   a Brinell hardness test.
   b Rockwell hardness test.
5. Test on springs.
6. Compression test on cube.
7. Impact test.
8. Punch shear test.

Note: Any 6 of the above experiments are to be conducted.

PRODUCTION TECHNOLOGY LAB

Subject Code: 13ME2104 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- Practically understand different manufacturing processes in production technology.
- Practically understand the difference between cold working and hot working processes.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Prepare green sand mold for single-piece and multi-piece patterns.
- Create joints using electric arc, spot, gas welding techniques.
- Outline practical procedure for TIG and MIG welding.
- Form plastic parts using injection and blow molding.
- Fabricate a pipe bend and a washer using hydraulic and mechanical press.

LIST OF EXPERIMENTS:

I. MOLDING PRACTICE:

1. Preparation of a green sand mould using single piece pattern.
2. Preparation of a green sand mould using multi piece pattern.

II. WELDING PRACTICE:

3. Preparation of a butt joint using electric arc welding.
4. Preparation of a lap joint using arc welding.
5. Preparation of a lap joint using spot welding.
6. Demonstration on gas cutting, spot welding, brazing using gas welding equipment.
7. Demonstration on Tungsten Inert Gas (TIG welding.
8. Demonstration on Metal Inert Gas (MIG welding.

III. PLASTIC MOLDING:

9. Injection Molding.
10. Blow Molding.

IV. MECHANICAL PRESSES:

11. Preparation of a pipe bending using hydraulic press.
12. Preparation of a washer using mechanical press.

ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

Subject Code: 13HS2102 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- Aware to different kinds of Learner-friendly approaches of language to an array of self-instructional learning (Computer based).
- Achieving reasonably good level of competency in Group Discussions, Presentations and Public speaking.
- Facilitating in how to face interviews.
- Providing a wide range of vocabulary to perform better in International tests like GRE, TOEFL, and IELTS etc.
- Gathering ideas and organize them relevantly and coherently.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Recognize and compare various socio-cultural and professional contexts appropriately.
- Evaluate their own performance participating well in GDs and other language-related activities.
- Experiment language more effectively and carry out various competitive examinations well.
- Compose the ideas relevantly and coherently.
- Discuss and report various situations efficiently

Syllabus:

1. Vocabulary Development.
2. Reading Comprehension.
3. Presentation Skills.
4. Group Discussions.
5. Resume Writing & Interview Skills.

TEXT BOOKS:

1. Speak Well, K. Nirupa Rani, Jayashree Mohan Raj, B. Indira, Orient Blackswan Pub., Hyderabad.
2. Strengthen Your Steps, M. Hari Prasad, John Varghese, R. Kishore Kumar, Maruthi Pub., Hyderabad.

REFERENCES BOOKS:

1. A Text Book of English Phonetics: For Indian Students, T. Balasubramanian, MacMillan Pub.
2. How to Prepare for Verbal Ability and Reading Comprehension for CAT, Arun Sharma, Meenakshi Upadhyay, Tata McGraw Hill Pub.

ADVANCED ENGINEERING DRAWING PRACTICE

Subject Code: 13ME2102 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To gain knowledge on projections of planes and solids using auxiliary views.
- To gain Knowledge on sectional views of various solid bodies.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Draw auxiliary views of regular planes and solids on auxiliary planes.
- Draw sectional views of simple solid bodies resting on their base.
- Develop lateral surfaces of right regular solids and transition pieces.
- Generate views of interpenetrated simple solids like cylinder & cylinder, cylinder & prism, cylinder & cone.
- Draw perspective projection of simple solids using vanishing point method.

UNIT-I

PROJECTIONS ON AUXILIARY PLANES:

Auxiliary views of regular planes and regular solids.

UNIT-II

SECTIONS OF SOLIDS:

Sections of Prisms, Pyramids, Cylinders and Right circular cones resting on their base.

UNIT-III

DEVELOPMENTS OF SURFACES:

Development of lateral surfaces of right regular solids, Development of lateral surfaces of transition pieces.

UNIT-IV

INTERPENETRATION OF SOLIDS:

Interpenetration of cylinder and cylinder, cylinder and prism, cylinder and cone.

UNIT-V

PERSPECTIVE PROJECTIONS:

Principles and definitions, Perspective projection of simple solids using vanishing point method.

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt, Charotar Pub.
2. Engineering Drawing, Dhananjay. M. Johle, Tata McGraw Hill Pub.

SELF STUDY COURSE – I

Subject Code: 13ME2201 **Internal Marks: 75**
Credits: 1

COURSE OBJECTIVES:

- To identify sources of information.
- To collect relevant information.
- To interpret information.
- To move from problem to solution.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Select relevant information from various sources including internet, library, journals, papers, mechanical engineering magazines.
- Present advanced topics in mechanical engineering like modeling and simulation of mechanical systems, design and analysis of various components etc.
- Participate actively in group discussions related to mechanical or general engineering topics.

1. Data collection through internet related to mechanical engineering.

2. Data collection from library and other sources related to mechanical engineering.

3. Seminar presentation on advanced topics like modeling and simulation of different mechanical engineering systems, design and analysis of various components.

4. Group discussion related to mechanical engineering.

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Subject Code: 13HS2004 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To explain the nature and scope of economics.
- Study the conditions under which a firm has to operate.
- How decision making is done in business.
- Financial accounts preparation, practice, interpretation and analysis.

COURSE OUTCOMES:

On completion of the course the student will be able to

- Explain demand and the factors that influence demand.
- Apply demand forecasting methods to determine quantity of demand.
- Understand production. Calculate minimum quantity that needs to be produced to make profit.
- Understand markets and pricing mechanism. Develop strategies for introducing products into markets.
- Utilize accounting concepts and conventions in business transactions to know the financial health of the organization.

UNIT-I

Introduction to Economics-Definition of Economics, Characteristics and Scope –Economics and its relation with other subjects- Basic economic tools, macro and microeconomics, concept of national income. Economic indicators

Demand Analysis & Demand Forecasting- Meaning of Demand, Demand determinants, Law of Demand and its exceptions.

Demand Forecasting: Meaning - Factors governing demand forecasting - Methods of demand forecasting (survey method, Delphi method, Collective opinion, Analysis of Time series and Trend projections, Economic Indicators, Controlled experiments and Judgmental approach - Forecasting demand for new products-

Elasticity of Demand -Definition -Types of Elasticity of demand - Measurement of price elasticity of demand: Point method and Arc method- importance of Elasticity of Demand.

UNIT-II

Theory of Production- Production Function- Law of variable proportions, Isoquants and Isocosts,- Least Cost Combination of Inputs, Law of returns to scale, Cobb-Douglas Production function - Economies of Scale.

Cost Analysis: Cost concept, revenues and costs, types of costs and their suitability for application.- Determination of Break-Even Point - Managerial importance and limitations of BEP.

UNIT-III

Introduction to Markets-

Pricing Policies: Market structures: Types of markets and types of competition, Features of Perfect Competition, Monopoly and Monopolistic Competition. Price-Output Determination under Perfect Competition, Monopoly, Monopolistic Competition -

Pricing methods: Methods of Pricing-Marginal Cost Pricing, Limit Pricing, Market Skimming, Penetration Pricing, Bundling Pricing and Peak Load Pricing. Internet Pricing Models: Flat rate pricing, Transaction based pricing, Priority pricing, charging on the basis of social cost, Precedence model,

Types of Industrial Organizations & Introduction to business cycles:
Evolution of organization structures. Features of Sole Proprietorship, Partnership, Joint Stock Companies and Public Enterprises. Introduction to business cycles: - Features of business cycles. Phases of business cycles.

UNIT-IV
Capital and Capital Budgeting: Meaning of capital budgeting, Need for capital budgeting – Capital budgeting decisions - Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR, IRR and Net Present Value Method (NPV method. Preparation of changes in working capital statement and fund flow statement.

UNIT-V
Introduction to Financial Accounting: financial accounting principles, Introduction to Double-entry system, Journal, Ledger, Trial Balance- Final Accounts with adjustments- Limitations of Financial Statements.
Interpretation and analysis of Financial Statements: Ratio Analysis – Liquidity ratios, Capital Structure ratios, Profitability ratios and solvency ratios –. Accounting conventions. International financial reporting standards.

TEXT BOOKS:
1. R G Lipsey K A Chrysal ECONOMICS OUP 10/e
2. S N Maheshwari Financial accounting S Chand & co , New Delhi, 2011

REFERENCE BOOKS:
1. A R Aryasri - Managerial Economics and Financial Analysis, TMH 2011
2. Craig. H. Peterson , W. Cris Lewis & Sudhir .K. Jain, Managerial Economics 4/e, Pearson Pub.
3. H L Ahuja, Advanced Economic Theory, S Chand & Co.

FLUID MECHANICS AND HYDRAULIC MACHINERY

Subject Code: 13ME2008 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide knowledge on different fluid properties and fluid flow.
- To provide basic knowledge on hydraulic turbines and pumps.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Define various physical properties of fluids, and understand how manometers are used to measure fluid pressure. List various flow classifications.
- Derive and solve problems based on continuity equation. Apply Euler, Bernoulli, Navier-Stokes, Impulse-momentum equations to solve practical fluid flow problems.
- Compute losses in fluid flow using Darcy Weisbach equation. Explain and solve problems based on various flow measurement devices.
- Illustrate mechanism and construction of various Hydraulic Turbines like Pelton wheel, Kaplan and Francis. Compute efficiencies and select suitable turbine using characteristic curves, governing and cavitation.
- Calculate efficiency and performance characteristics of centrifugal and reciprocating pumps.

UNIT-I

INTRODUCTION:

Dimensions and units – Physical properties of fluids: Specific gravity, Viscosity, Surface tension, Vapor pressure and their influences on fluid motion – Pressure at a point, Pascal's law, Hydrostatic law – Atmospheric, Gauge and Vacuum pressure – Measurement of pressure – Pressure gauges, Differential and micro manometers.

FLUID KINEMATICS - I:

Description of fluid flow, Stream line, Path line, Streak lines, Stream tube – Classification of flows: Steady & Unsteady, Uniform & Non-uniform, Laminar & Turbulent, Rotational & Irrotational flows.

UINT-II

FLUID KINEMATICS - II:

Equation of continuity for one, two, and three dimensional flows – Stream and velocity potential functions – Flow net analysis.

FLUID DYNAMICS:

Surface and body forces – Euler's and Bernoulli's equations for flow along a streamline for 3-D flow – Navier-Stokes equations (Explanatory – Momentum equation and its application, Forces on a pipe bend – Reynold's experiment, Characteristics of laminar and turbulent flows – Flow between parallel plates, Flow through long tubes, Flow through inclined tubes.

UINT-III

CLOSED CONDUIT FLOW:

Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – Pipes in series and parallel – Total energy line, Hydraulic gradient line.

MEASUREMENT OF FLOW:

Pitot tube, Venturimeter, Orifice meter, Flow nozzle, Turbine flow meter.

UNIT-IV

HYDRAULIC TURBINES:

Classification of turbines – Impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine -working proportions, work done, efficiencies – Hydraulic design – Draft tube: theory, functions, efficiency.

PERFORMANCE OF HYDRAULIC TURBINES:

Geometric similarity, Units and specific quantities, Characteristic curves, Governing of turbines, Selection of type of turbine, Cavitation, Surge tank, Water hammer.

UNIT-V

CENTRIFUGAL PUMPS:

Classification, working, work done – Manometric head, losses and efficiencies – Specific speed – Pumps in series and parallel – Performance characteristic curves, NPSH.

RECIPROCATING PUMPS:

Working, Discharge, Slip, Indicator diagrams.

TEXT BOOKS:

1. Hydraulics, Fluid Mechanics and Hydraulic Machinery, P.N. Modi, S.M. Seth, Standard Book House Pub.
2. Fluid Mechanics and Hydraulic Machines, R.K. Rajput, S.Chand Pub.

REFERENCES BOOKS:

1. Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S.K. Kotaria & Sons Pub.
2. Fluid Mechanics and Machinery, D. Rama Durgaiah, New Age Pub.
3. Hydraulic Machines, T.R. Banga, S.C. Sharma, Khanna Pub.
4. Fluid Mechanics, A.K. Jain, Khanna Publishers.

KINEMATICS OF MACHINERY

Subject Code: 13ME2009 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand different mechanisms and their constraints.
- To get clear idea about planar mechanisms and spatial mechanisms.
- To determine velocity and acceleration of different parts in a given mechanism by using graphical as well as analytical techniques.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Identify and analyze the kinematic chain in a given machine. Differentiate inversions of four bar, slider crank and double slider crank mechanism and their applications.
- Explain the working and solve simple problems of both exact and approximate straight line motion mechanisms, steering gears, hooks joints and their applications.
- Draw the velocity and acceleration diagrams of various mechanisms and determine velocities and accelerations of different parts in a given mechanism.
- Draw the CAM profile for the given follower motion which may include a combination of uniform velocity, uniform acceleration/retardation, simple harmonic motions.
- Determine spur, helical or bevel gears dimensions that meet the specified requirements. Analyze transmission ratios in planetary and differential gear system. Understand working of automobile differential.

UNIT – I

MECHANISMS:

Elements or Links, Classification: Rigid Link, Flexible and Fluid link – Types of kinematic pairs: Sliding, Turning, Rolling, Screw, Spherical pairs; Lower and higher pairs; Closed and open pairs – Constrained motion: Completely, Partially or successfully constrained, Incompletely constrained. Introduction to kinematic synthesis.

MACHINES:

Mechanism and machines, Classification of machines, Kinematic chain – Inversion of mechanisms: inversions of quadric cycle chain, Single and double slider crank chains.

UNIT-II

STRAIGHT LINE MOTION MECHANISMS:

Exact and approximate copiers and generated types, Peaucellier, Hart and Scott Russel, Grasshopper, Watt Chebicheff and Robert Mechanisms and straight line motion, Pantograph.

STEERING MECHANISMS:

Conditions for correct steering – Davis Steering gear, Ackerman's steering gear, Velocity ratio.

HOOKE'S JOINT:

Single and double Hooke's joint – Universal coupling, Application, Problems.

UNIT-III

KINEMATICS:

Velocity and acceleration, Motion of link in machine, Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method for four bar chain.

ANALYSIS OF MECHANISMS:
Analysis of slider crank chain for displacement, velocity and acceleration of slider – Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, Determination of Coriolis component of acceleration.

PLANE MOTION OF BODY:
Instantaneous center of rotation, centrodes & axodes – Relative motion between two bodies – Three centers in a line theorem – Graphical determination of instantaneous centre, Diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT-IV
CAMS:
Definitions of cam and followers, Uses, Types of followers and cams, Terminology, Types of follower motion: Uniform velocity, Uniform acceleration, Simple harmonic – 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.

UNIT-V
GEARS:
Higher pairs, Friction wheels, Toothed gears, Types, Law of gearing, Condition for constant velocity ratio for transmission of motion – Forms of teeth: cycloidal and involute profiles – Sliding Velocity – Phenomena of interference, 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.

GEAR TRAINS:
Introduction, Train value, Types – Methods of finding train value or velocity ratio for: Simple and reverted gear train, Epicyclic gear train – Selection of gear box – Differential gear of an automobile.

TEXT BOOKS:
1. Theory of Machines and Mechanisms, S.S. Rattan, Tata McGraw Hill Pub.
2. Theory of Machines, R.S Khurmi, J.K Gupta, S. Chand Pub.

REFERENCES BOOKS:
1. Theory of Machines, P.L. Ballaney, Khanna Pub.
2. Theory of Machines, R.K Bansal, Laxmi Pub.
3. Theory of Machines, Sadhu Singh, Pearson Pub.
4. Theory of Machines, John Joseph Uicker, G. R. Pennock, Joseph Edward Shigley, Oxford Press Pub.

DESIGN OF MACHINE MEMBERS – I

Subject Code: 13ME2010 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide an understanding of the analytical design techniques used in design machine members.
- To understand Stress analysis, Working stresses, Failure theories, Fatigue failure.
- To design Riveted, Welded, Bolted joints and Pressure Vessels.
- To provide design methods for Shafts, Keys and couplings and Springs.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Describe general considerations in design, selection of materials and manufacturing. Solve problems based on different theories of failure and design for fluctuating stresses.
- Design riveted joints with special emphasis on boiler joints, and welded joints with initial stresses and for eccentric loading.
- Design bolted joints with pre-stress and eccentric loading. Determine change in dimensions of thin and thick, simple and compound pressure vessels due to internal pressure.
- Design keys, cotter joints (spigot & socket, sleeve & cotter, jib & cotter and knuckle joints. Design hollow and solid shafts for strength and rigidity with combined bending and axial loading.
- Design rigid couplings (muff, split-muff, flange and flexible couplings. Design helical springs, helical torsional springs and leaf springs for static and fatigue loadings..

UNIT – I

INTRODUCTION:

General considerations in design of engineering materials and their properties, Material selection – Manufacturing considerations in design.

STRESSES IN MACHINE MEMBERS:

Simple stresses, Combined stresses, Torsional and bending stresses, Impact stresses, Stress-strain relation – Various theories of failure, Factor of safety – Design for strength and rigidity – Preferred numbers – Concept of stiffness in tension, bending, torsion and combined situations – Static strength – Design based on fracture toughness.

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, Goodman line, Soderberg line, Modified Goodman line.

UNIT – II

RIVETED JOINTS:

Design of riveted joints with initial stresses, Eccentric loading – Design of boiler joints, Design of longitudinal butt joint for a boiler, Design of circumferential lap joint for a boiler, Lozenge joint.

WELDED JOINTS:

Design of welded joints with initial stresses, Eccentric loading – Strength of transverse fillet welded joints, Strength of parallel fillet welded joints, Special cases of fillet welded joints – Axially loaded unsymmetrical welded sections – Polar moment of inertia and section modulus of welds.

UNIT – III

BOLTED JOINTS:

Design of bolts with pre-stresses – Design of bolted joints under eccentric loading – Locking devices – Bolts of uniform strength – Different seals.

PRESSURE VESSELS:

Stress in a thin cylindrical shell due to internal pressure, Hoop stress, Longitudinal stress – Change in dimensions of a thin cylindrical shell due to internal pressure, Change in dimensions of a thin spherical shell due to internal pressure – Thick cylindrical shell subjected to internal pressure – Compound cylindrical shells and their stresses, Cylinder heads and cover plates.

UNIT – IV

KEYS, COTTERS AND KNUCKLE JOINTS:

Design of keys, Stresses in keys – Cotter joints: Spigot and socket, Sleeve and cotter, Jib and cotter – 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.

UNIT – V

SHAFT COUPLING:

Rigid couplings: Muff, Split-muff and flange couplings – Flexible couplings, Flange coupling (modified.

MECHANICAL SPRINGS:

Stresses and deflections of helical springs, Extension and compression of springs – Springs for fatigue loading – Energy storage capacity – Helical torsion springs – Coaxial springs, Leaf springs.

TEXT BOOKS:

1. Machine Design, V.B. Bhandari, Tata McGraw Hill Pub.
2. Machine Design, R.S. Khurmi, J.K. Gupta, S. Chand Pub.
3. Machine Design Data Book, S. Md. Jalaluddin, Anuradha Pub. (**Permitted for Exam**
4. Machine Design Data Book, V.B. Bhandari, Tata McGraw Hill Pub.(**Permitted for Exam**

REFERENCES:

1. Machine Design, Allen Strickland Hall, A. Holowenko, Herman G. Laughlin, Schaum Series, Tata McGraw Hill Pub.
2. Shigley’s Machanical Engineering Design, Joseph E Shigley, Tata McGraw Hill Pub.
3. Machine Design, N.C. Pandya, C.S. Shaw, Charotar Pub.
4. Machine Design, S. Md. Jalaluddin, Anuradha Pub.

THERMAL ENGINEERING – I

Subject Code: 13ME2011 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To learn the testing and performance of different IC engines.
- To learn about air cycles and their analysis.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Analyze standard vs. actual air cycles in terms of various losses. Understand construction, working and mechanism of fuel, cooling and lubrication engine subsystems.
- Describe major flow and combustion processes occurring in SI engines. Identify the factors affecting flame speed, ignition lag, flame propagation and knocking.
- Discuss processes of combustion in CI engine and effect of various parameters. Explain diesel knock reduction methods like swirl and auto-ignition.
- Calculate engine performance using various parameters and heat balance sheet.
- Explain operating principles of rotary, reciprocating and axial flow compressors.

UNIT – I

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.

I.C. ENGINES:

Classification, Working principles, Valve and port timing diagrams – Air-standard, air-fuel and actual cycles – Engine systems, Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, Principle of Wankel engine.

UNIT-II

COMBUSTION IN S.I. ENGINES:

Normal combustion and abnormal combustion, Importance of flame speed and effect of engine variables, Types of abnormal combustion, Pre-ignition and knocking, Fuel requirements and fuel rating, Anti-knock additives, Combustion chamber requirements, types.

UNIT-III

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 – Fuel requirements and fuel rating.

UNIT-IV

TESTING AND PERFORMANCE:

Parameters of performance – Measurement of cylinder pressure, Fuel consumption, Air intake, Exhaust gas composition – Brake power, Determination of frictional losses and indicated power – Performance test – Heat balance sheet.

UNIT-V

COMPRESSORS:

Classification, Positive displacement and rotodynamic machinery.

RECIPROCATING COMPRESSORS:
Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency – Effect of clearance, Stage compression, Undercooling, Saving of work, Minimum work condition for stage compression.

ROTARY COMPRESSORS: (Positive displacement type
Roots Blower, Vane sealed compressor, Lysholm compressor – mechanical details and principles of working, efficiency considerations.

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.

TEXT BOOKS:
1. Internal Combustion Engines, V.Ganesan, Tata McGraw Hill Pub.
2. A Course in Internal Combustion Engines, M. L. Mathur, R. P.Sharma, Dhanpat Rai Pub.
3. Thermal Engineering, R.K. Rajput, Laxmi Pub.

REFERENCES BOOKS:
1. Thermal Engineering, P.L.Ballaney, Khanna Pub.
2. Internal Combustion Engine Fundamentals, John B Heywood, McGraw Hill Pub.
3. A Course in Thermal Engineering, S.C. Arora, S. Domukundwar, Dhanpat Rai Pub.

MACHINE DRAWING

Subject Code: 13ME2012 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide knowledge on views of different machine parts.
- To draw the assemblies of engine parts.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Reproduce conventions of machine parts and their necessity.
- Draw simple machine elements including screw threads, bolts, nuts, keys.
- Draw simple machine elements including cotter and knuckle joints, riveted joints, shaft couplings, journal and foot-step bearings.
- Draw assembly drawings of engine parts like stuffing box, steam engine cross head, eccentric, connecting rod, piston assembly.
- Draw assembly drawings of other machine parts like screw jack, vice, Plummer block, lathe tailstock, and valves like steam stop valve, spring loaded safety valve, feed check valve.

MACHINE DRAWING CONVENTIONS:

Need for drawing conventions, Introduction to ISI conventions

(i Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.

(ii Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.

I. DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS:

Selection of views, Additional views for the following machine elements and parts with easy drawing proportions.

(i Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.

(ii Keys, cotter joint and knuckle joint.

(iii Riveted joints for plates.

(iv Shaft coupling, spigot and socket pipe joint.

(v Journal bearing and foot step bearing.

II. ASSEMBLY DRAWINGS:

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

(i Engine parts – Stuffing box, Steam engine cross head, Eccentric, Petrol engine connecting rod, piston assembly.

(ii Other machine parts – Screw jack, Machine vice, Plummer block, Lathe tailstock.

(iii Valves – Steam stop valve, Spring loaded safety valve, Feed check valve.

III. COMPUTER AIDED DRAWING OF COMPONENTS (Demonstration only.

TEXT BOOKS:

1. Machine Drawing, K.L. Narayana, P. Kannaiah, K. Venkata Reddy, New Age Pub.
2. Machine Drawing, N D Bhatt, Charotar Pub.

REFERENCES BOOKS:

1. Machine Drawing, R.K. Dhawan, S.Chand Pub.
2. Machine Drawing, P.S.Gill, Tata McGraw Hill Pub.
3. Machine Drawing, Basudeb Bhattacharya, Oxford Pub.

CAD & MAT LAB

Subject Code: 13ME2105 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To understand the fundamentals of computer aided drafting and generation of basic lines and profiles in computer graphics.
- To develop basic knowledge on usage of Matlab to solve engineering problems

COURSE OUTCOMES:

On completion of this course, students should be able to

- Draw basic lines and profiles with commonly used operations in AutoCAD
- Generate 2D drawings along with dimensioning in AutoCAD.
- Apply constraints, use layering concepts, and create assembly drawings.
- Write Matlab code for root finding, solving system of linear equations, curve fitting and optimization.
- Develop Matlab code to solve Ordinary Differential Equations using Runge Kutta and Finite Difference Methods..

CAD LAB

INTRODUCTION TO COMPUTER AIDED SKETCHING (2-D DRAWINGS:

(i Commands – Axes, Coordinate points, Creation of lines, Polylines, Square, Rectangle, Polygons, Splines, Circles, Ellipse, Text.

(ii Move, Copy, Offset, Mirror, Rotate, Trim, Extend, Break, Chamfer, Fillet, Curves.

(iii Constraints: Tangency, Parallelism, Inclination and Perpendicularity.

(iv Dimensioning, Limits, Fits, Applying tolerances on individual dimensions.

AUTOCAD/MECHANICAL DESKTOP PRACTICE:

Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, Assembly, Basic principles of GD&T (Geometric Dimensioning & Tolerancing.

MAT LAB

LIST OF EXPERIMENTS: Write Matlab Program for

1. Roots of an equation by (a Bisection, (b Newton methods.
2. Solution of systems of equations using direct Gauss elimination method.
3. Natural cubic spline that interpolates a table of values.
4. Least square polynomial fit of degree m that best fits a table of X and Y values.
5. Minimum of a function using Fibonacci method.
6. Definite Integral using Trapezoidal rule and Simpsons rule.
7. Definite integral using Gaussian Quadrature formula.
8. Solution of ODE using Runge-Kutta 2^{nd} & 4^{th} order method.
9. Solution of ODE using finite difference methods.
10. Solution of parabolic PDE using Crank-Nicolson method.
11. Solution of hyperbolic PDE using 3-level explicit method.
12. Solution of elliptic PDE Using 5-point difference formula.

Note: Any 6 of the above 12 programs are to be written.

TEXT BOOKS:

1. Computer Aided Engineering Drawing , S. Trymbaka Murthy, I.K. International Pub.
2. Introduction to Numerical Methods, A Matlab Approch, Abdelwahab Kharab, Ronald B Guenther, Chapman & CRC Press.

REFERENCES BOOKS:

1. AutoCAD Commands Reference Manual, Autodesk Pub.

FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

Subject Code: 13ME2106 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To give the practical exposure about fundamentals of fluid mechanics and hydraulics.
- To provide practical knowledge about the turbo-machinery.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Conduct impact of jet on vanes, and performance test on Pelton wheel.
- Conduct performance tests on Francis turbine and Kaplan turbine.
- Conduct performance tests on single-stage and multi-stage centrifugal pump and reciprocating pump.
- Calibrate venture-meter and orifice-meter.
- Determine head loss and friction factor for a given pipeline.

LIST OF EXPERIMENTS:

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

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

PROFESSIONAL ETHICS AND MORALS

Subject Code: 13HS2201 **Credits: 0**

COURSE OBJECTIVES:

- To make students aware of impact of taking non-ethical engineering decisions.
- To understand that mind and desire control is needed for being ethical.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Recognize the importance of human values like respecting others, punctuality, politeness, living peacefully, caring, sharing, honesty, courage, cooperation, commitment, empathy, spirituality, character etc.
- Understand that excessive desires of mind make a person unethical and restless, while fewer desires leads to peace and spiritual progress.
- Assess different types of risks involved in taking unethical decisions. Know various means of protesting unethical decisions.
- Assess the benefits of restraining from unethical practices like bribery, extortion, nepotism, nexus between politicians and industrialists, collective bargaining, industrial espionage, price fixing, endangering lives, whistle-blowing.
- Summarize case studies of ethical violations including Chernobyl, Tepco, Challenger, Ford Pinto disasters.

UNIT-I
INTRODUCTION TO VALUES AND MORALS:

Theory of Evolution, Ethics as a necessity for spiritual evolution, Description of human values & morals --- – Values: Integrity, Honesty, Courage, Empathy, Personality, Character, Self-Confidence, Respect for Others – 7 Ways of Misusing Truth – Work culture, Social responsibility, Responsibilities as a citizen, Cooperation and commitment, Caring and sharing – Religion vs. Spirituality, Philosophy, Customs and practices – Impediments to responsibility: Self-interest, Fear, Self-deception, Ignorance, Ego, Narrow vision, Uncritical acceptance of authority, Group thinking.

UNIT-II
MIND AND ITS MYSTERIES:

What is Mind? Mind and body, Mind and food – Mental faculties – Theory of perception, Memory, Tendencies, Thought Creates the World, Power of Thought, Thought-Culture, Desires, Pleasure and Pain – Cultivation of Virtues, Control of Senses and Mind – Discrimination, Dispassion, Sacrifice – Concentration, Meditation and Enlightenment.

UNIT-III
RISK, SAFETY AND ENVIRONMENT:

Difficulties in estimating risk – Approach to acceptable risk, Regulator's approach to risk – Engineer's liability, Changing legal rights of the employees – Organizational disobedience: by contrary action, by non-participation, by protest – Environmental laws and judicial intervention in related matters – Environmental Movements.

UNIT-IV

NON-ETHICAL PRACTICES IN VOGUE:

Engineer's responsibility for rights – Respect for authority – Conflict of Interests, Occupational crime – Global Issues, How multinational corporations influence government decisions, Risk and public policy – Engineers as managers, advisors and experts, Engineers as moral leaders – Problem of bribery, extortion, grease payments, nepotism – Nexus between politicians and industrialists.

Case Study: Chinese Minister Sentenced to Death for Corruption.

UNIT-V

CASE STUDIES – VARIETY OF MORAL ISSUES IN PROFESSION:

Chernobyl nuclear disaster, Air bags, Cadillac Chips, Nuclear Power Generation Plant, Highway Safety, Microwaves, Renewable Energy, Training Fire Fighters.

TEXT BOOKS:

1. Engineering Ethics, Charles E Harris, Micheal J Rabins, Cengage Learning Pub.
2. Ethics in Engineering, Mike Martin and Roland Schinzinger, McGraw Hill Pub.
3. Mind, Its Mysteries and Control, Swami Sivananda, Divine Life Society Pub.

DYNAMICS OF MACHINERY

Subject Code: 13ME3013 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To learn graphical and analytical synthesis of linkage mechanisms for function generation, motion generation, and path generation.
- To provide the tools necessary for kinematic and dynamic analysis of mechanisms and machines.
- To provide skills necessary to consider the role of dynamics in the design of machines.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Enumerate Dynamic Analysis of Four bar Linkage and Slider crank Mechanism. Evaluate energy stored and dimensions of flywheel.
- Explain working principles of different governors. Solve problems on gyroscopic effects in ships, automobiles and airplanes.
- Discuss the working principles and types of clutches and brakes. Calculate frictional forces in clutches and brakes.
- Evaluate various cases of balancing of rotating masses. Use analytical and graphical methods for primary and secondary balancing of reciprocating masses.
- Compute natural frequencies of free and forced, undamped and damped, 1 and 2 dof, longitudinal, transverse and torsional vibrating spring mass systems. Explain whirling of shafts, vibration isolation and transmissibility.

UNIT – I

STATIC AND DYNAMIC FORCE ANALYSIS OF PLANAR MECHANISMS:

Turning moment, Inertia, Torque – Connecting rod's angular velocity and angular acceleration – Crank effort and torque diagrams – Fluctuation of energy – Flywheels and their design.

UNIT – II

GOVERNERS:

Watt, Porter and Proell governors – Spring loaded governors: Hartnell and Hartung with auxiliary springs – Sensitiveness, isochronism and hunting.

GYROSCOPES:

Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in automobiles, ships and airplanes.

UNIT –III

FRICTION:

Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear.

CLUTCHES:

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 – Dynamometers: Absorption type, Transmission type – General description and methods of operations.

UNIT – IV

BALANCING:

Balancing of rotating masses: single and multiple, single and different planes.

BALANCING OF RECIPROCATING MASSES:

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 efforts.

UNIT – V

VIBRATIONS:

Free Vibration of mass attached to vertical spring – Oscillation of pendulums, Centers of oscillation and suspension – Transverse loads, Vibrations of beams with concentrated and distributed loads – Dunkerley's methods, Raleigh's method – Whirling of shafts, Critical speeds, Torsional vibrations, Two and three rotor systems – Simple problems on forced damped vibration – Isolation & Transmissibility.

TEXT BOOKS:

1. Theory of Machines, S.S. Ratan, Tata McGraw Hill Pub.
2. Theory of Machines, R.S. Khurmi, J.K. Gupta, S. Chand Pub.

REFERENCES BOOKS:

1. Theory of Machines, Sadhu Singh, Pearson Pub.
2. Theory of Machines, P.L. Ballaney, Khanna Pub.
3. Mechanical Vibrations, Singeresu. S. Rao, Pearson Pub.

METAL CUTTING & MACHINE TOOLS

Subject Code: 13ME3014 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide basic knowledge on different machines like lathe, shaper, and planner.
- To provide clear information on cutting tool geometry.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Assess machinability of different materials using specific cutting forces and surface finish. Explain theory of metal cutting including cutting tool geometry, materials, life and wear.
- Describe basic parts and various operations performed on lathe. Explain the mechanisms used in various special purpose lathes.
- Discuss parts, working principles, operations and applications of shaping, slotting, planning, milling, drilling, broaching and grinding machines.
- Explain gear cutting, gear forming, gear generation, gear shaping and gear hobbing.
- Explain constructional details, working principles and applications of CNC machines.

UNIT-I

THEORY OF METAL CUTTING:

Introduction, Material removal processes, Types of machine tools – Theory of metal cutting, Cutting tool geometry, Chip formation – Orthogonal cutting, Merchant's Force diagram – Cutting tool materials, Tool wear, Tool life, Surface finish – Cutting fluids.

UNIT-II

CENTRE LATHE:

Constructional features, Various operations, Taper turning methods, Thread cutting methods – Special attachments, Machining time and power estimation.

SPECIAL PURPOSE LATHES:

Capstan and turret lathes, Automats, Single spindle, Swiss type, Automatic screw type, Multi spindle, Turret Indexing mechanism, Bar feed mechanism.

UNIT-III

RECIPROCATING MACHINE TOOLS:

Shaper, Planer and Slotter.

MILLING, DRILLING AND ALLIED OPERATIONS, BROACHING:

Types, Milling cutters, Operations, Indexing – Hole making, Drilling, Quill mechanism, Reaming, Boring, Broaching machines, Broach construction, Push, Pull, Surface and Continuous Broaching machines.

UNIT-IV

ABRASIVE PROCESSES AND GEAR CUTTING:

Abrasive processes, Grinding wheel, Specifications and selection, Types of grinding process, Cylindrical grinding, Surface grinding, Centreless grinding – Honing, Lapping, Super finishing, Polishing and Buffing, Abrasive jet machining, Gear cutting, Forming, Generation, Shaping, Hobbing.

UNIT-V

CNC MACHINE TOOLS AND PART PROGRAMMING:

Numerical control (NC machine tools – CNC: Types, Constructional details, Special features, Design considerations of CNC machines for improving machining accuracy – Structural members, Slide ways, Linear bearings, Ball screws, Spindle drives and Feed drives – Part programming fundamentals, Manual program

TEXT BOOKS:

1. A Text Book of Production Engineering, P.C. Sharma, S. Chand Pub.
2. Numerical Control and Computer Aided Manufacturing, T.K. Kundra, P.N. Rao, N.L.K. Tiwari, Tata McGraw Hill Pub.

REFERENCES BOOKS:

1. Production Technology, R.K. Jain, S.C. Gupta, Khanna Pub.
2. Workshop Technology Vol-II, B.S. Raghuwanshi, Khanna Pub.
3. Metal Cutting Principles, Milton C Shaw, CBS Pub.
4. Metal Cutting and Machine Tools, Geoffrey Boothroyd, CRC Press.

DESIGN OF MACHINE MEMBERS - II

Subject Code: 13ME3015 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide knowledge on shafts, couplings and welded joints.
- To provide knowledge on design of power screws.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Design journal, ball, roller and thrust bearings with adequate bearing life and heat dissipation.
- Compute dimensions of connecting rod, crank and crankshaft that can sustain various loads.
- Design piston and cylinder for structural and thermal loads. Design power transmission components like flat & v-belts, ropes, chains, pulleys for belt and rope drives.
- Calculate major dimensions of spur and helical gears for dynamic loads, bending strength, compressive strength and wear.
- Design power screws and screw jack along with the nut. Design machine tool beds, slide ways, spindles for strength and rigidity.

UNIT – I

BEARINGS:

Types of Journal bearings, Lubrication, Bearing modulus, Full and partial bearings, Clearance ratio, Heat dissipation of bearings, Bearing materials, Journal bearing design, Ball and roller bearings, Static loading of ball and roller bearings, Bearing life, Thrust bearings, Pivot bearings, Collar bearings, Split bearings.

UNIT – II

CONNECTING ROD:

Thrust in connecting rod, Stress due to whipping action on connecting rod ends.

CRANK AND CRANK SHAFT:

Strength & proportions of overhung & center crank shaft, Crank pins, Valve gear mechanism, Rocker Arm.

UNIT – III

PISTON:

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

CYLINDER:

Cylinder, Cylinder liners, Design of a cylinder, Material for piston and cylinder.

POWER TRANSMISSIONS SYSTEMS AND PULLEYS:

Transmission of power by belt and rope drives, Transmission efficiencies, Belts: Flat, V types, Ropes, Pulleys for belt and rope drives, Materials, Chain drives.

UNIT – IV

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 – V

DESIGN OF POWER SCREWS:

Design of Screws – Square, ACME, Buttress Screws – Design of Nut – Compound screw, Differential screw, Ball screw, Possible failures – Overhauling and self-locking screws – Stresses in power screws – Design of screw jack.

MACHINE TOOL ELEMENTS:

Design of beds, Slide ways, Spindles – Material selection, Design for strength and rigidity of parts.

TEXT BOOKS:

1. Machine Design, V.B. Bhandari, Tata McGraw Hill Pub.
2. Machine Design, R.S. Khurmi, S. Chand Pub.
3. Machine Design Data Book, S. Md. Jalaluddin, Anuradha Pub.(**Permitted for Exam**
4. Machine Design Data Book, V.B. Bhandari, Tata McGraw Hill Pub.(**Permitted for Exam**

REFERENCES BOOKS:

1. Machine Design, Schaum Series, Tata McGraw Hill Pub.
2. Machine Design, Joseph E. Shigley, McGraw Hill Pub.
3. Machine Design, N.C. Pandya and C.S. Shaw, Charotar Pub.
4. Machine Design, S.Md. Jalaluddin, Anuradha Pub.

CAD/CAM

Subject Code: 13ME3016 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide basic knowledge on computer aided drafting and modeling.
- To provide knowledge on computerized numerical control, process planning & manufacturing systems.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Describe CAD devices and software, graphic standards. Apply 2D & 3D transformations and inverse transformations.
- Develop mathematically synthetic curves and surfaces including Bezier curves and NURBS. Understand Boundary Representation (B-rep and Constructive Solid Geometry (CSG solid modeling methodologies.
- Write simple CNC programs to perform different operations like turning and milling.
- Explain group technology concepts, especially MICLASS and OPITZ coding systems in production to facilitate cellular and flexible manufacturing. Develop automated process plans using variant and generative approaches.
- Differentiate steps involved in migrating from conventional manufacturing to FMS & CIM.

UNIT-I

PRODUCT LIFE CYCLE:

CAD tools, CAD systems, CAD hardware, CAD specific I/O devices, Benefits of CAD – Working and Screen coordinate systems, Windowing, Modeling and Viewing – Image drawing techniques, Stroke writing, Raster scan graphical user interface, Graphics standards.

2D AND 3D TRANSFORMATIONS:

Geometric Transformations, Transformations of geometric models, Mapping of geometric models, Inverse transformations and mapping, Projections of geometric models.

UNIT-II

GEOMETRIC MODELING:

Wireframe models, Types and mathematical parametric representation of analytic and synthetic curves – Surface models, Types and mathematical parametric representation of analytic and synthetic surfaces – Solid models, Solid entities, Solid representation, Fundamentals of solid modeling, Introduction to Boundary Representation and Constructive Solid Geometry.

UNIT-III

NC/CNC:

Definition of NC, Basic components of NC systems, Types of NC control systems, NC machining centers, Applications of NC, Economics of NC, NC part programming methods, Data feeding methods, Simple part programming for turning and milling operations using both manual part programming and CNC – DNC machines and their advantages.

UNIT-IV

GROUP TECHNOLOGY:

History of Group Technology (GT, Role of GT in CAD/CAM integration, Part families, Classification and coding: MICLASS and OPITZ coding systems – Benefits of GT – Cellular manufacturing.

UNIT-V

PROCESS PLANNING:

Role of process planning in CAD/CAM integration, Approaches to computer aided process planning, Variant approach and generative approaches, CAPP and CMPP process planning systems.

FLEXIBLE MANUFACTURING SYSTEMS:

Definition of FMS, Components, Classification, Work station types, Functions of material handling and storage systems, FMS layout configuration, Computer control system and its functions, Economic justification of FMS, Applications and benefits.

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Ibrahim Zeid, Tata McGraw Hill Pub.
2. CAD/CAM Principles & Applications, P. N. Rao, Tata McGraw Hill Pub.
3. CAD/CAM, M.P. Groover, Emory Zimmers, Prentice Hall India Pub.

REFERENCES BOOKS:

1. Automation, Production Systems & Computer Integrated Manufacturing, M.P. Groover, PHI Pub.
2. Computer Integrated Manufacturing System, Yorem Koren, McGraw Hill Pub.
3. CAD/CAM/CIM, P. Radhakrishnan, S. Subramanyan, V. Raju, New Age Pub.

THERMAL ENGINEERING - II

Subject Code: 13ME3017 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide knowledge of steam turbines, steam nozzles and steam condensers.
- To provide knowledge on gas turbines and jet propulsions.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Calculate thermal efficiency of Rankine cycle with and without reheating and regeneration. Determine stoichiometric air required after converting from volumetric to mass analysis and vice-versa.
- Describe the function and working of various types of boilers along with its mountings and accessories. Calculate the boiler efficiency, chimney height for natural draught, and power to drive the fans.
- Design a nozzle for given requirements and calculate its efficiency. Understand the working of various types of steam condensers along with determining mass of cooling water required.
- Determine the performance of simple and compounded, impulse and multi-stage reaction turbines by drawing velocity diagrams and computing various efficiencies.
- Calculate efficiency of Brayton cycle along with reheating, regeneration and intercooler used in gas turbines. Describe the working principles of Ramjet, Pulsejet, Turbojet and Turboprop engines.

UNIT-I

RANKINE CYCLE:

Thermodynamic analysis of Rankine Cycle, Methods to improve cycle performance – Regeneration – Reheating – Binary-vapor cycles.

FUELS:

Calorific value determination, Stoichiometric air required – Conversion of volumetric to mass analysis and vice-versa – Flue gas analysis, ORSAT apparatus.

UNIT-II

BOILERS:

Working and sketches of:

(a) fire-tube boilers – Cochran, Cornish, Lancashire, Locomotive, Scotch
(b) water-tube boilers – Bobcock & Wilcox, Stirling
(c) high-pressure boilers – Lamont, Loeffler, Benson, Velox.

Boiler mountings and accessories. Natural draught chimney height, Condition for maximum discharge through chimney, Power required to drive forced-draught and induced-draught fans.

UNIT-III

STEAM NOZZLES:

Thermodynamic analysis, Condition for maximum discharge, Critical pressure ratio, Supersaturated flow, Wilson line.

STEAM CONDENSORS:

Jet, Surface and evaporative condenser types – working with sketches, vacuum and condenser efficiency, determination of mass of cooling water required.

UNIT-IV

IMPULSE TURBINES:

Compounding methods: Velocity, Pressure, Pressure-velocity – Velocity diagrams, Power developed, Axial thrust, Blade or diagram efficiency, Condition for maximum efficiency.

REACTION TURBINES:

Degree of reaction, Parson 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, intercooling and reheating – Closed and semi-closed cycles – Merits and demerits – Types of combustion chambers.

JET PROPULSION:

Working and schematic of Ramjet, pulsejet, turbojet and turboprop engines – Thrust power and propulsive efficiency for a turbojet engine.

TEXT BOOKS:

1. Thermal Engineering by R.K. Rajput, S.Chand Pub.
2. A Course in Thermal Engineering, S.C. Arora, V. Domukundwar, Dhanpat Rai Pub.
3. Steam Tables. (**Permitted in Exams**

REFERENCES BOOKS:

1. Thermal Engineering, P.L. Ballaney, Khanna Pub.
2. Thermal Engineering, R.S. Khurmi, J.K. Gupta, S. Chand Pub.
3. Gas Turbines and Propulsive Systems, P.R. Kajuria, S.P. Dubey, Dhanpat Rai Pub.

3D MODELING LAB

Subject Code: 13ME3107 **Internal Marks: 25**
Credits: 3 **External Marks: 50**

COURSE OBJECTIVES:

- To provide knowledge of modeling tools for creating solid and surface models.
- To provide knowledge on different CAD softwares.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Design 3D models using operations like extrude, revolve, shell, sweep etc.
- Design 3D models using features like move, pattern, mirror, fillet, chamfer etc.
- Create 2D surfaces using simple surfacing operations.
- Assemble individual 3D components using various assembly constraints.
- Draft 3D models to create 2D drawings including various views.

1. 3D Part modeling – Extrusion, Cut/hole, Sweep, Draft, Loft, Blend and Rib.
2. Editing – Move, Pattern, Mirror, Round and Chamfer
3. Conversion of 3D solid model to 2D drawing - Different views, Sections, Isometric view and Dimensioning
4. Introduction to Surface Modeling.
5. 3D modeling of machine elements like Flanged coupling and Screw jack.
6. Assembly Drawing (Using Application Packages

   Parts drawing and preparation of assembled views given part details for components followed by practicing the same using CAD packages.
7. Suggested Assemblies: (any 3

   Shaft couplings – Plummer block – Screw jack – Lathe Tailstock – Universal Joint – Machine Vice – Stuffing box – Safety Valves - Non-return valves – Connecting rod – Piston and crank shaft – Multi plate clutch – Preparation of Bill of materials and tolerance data sheet

Note: Use any of following modeling softwares: CATIA, UNIGRAPHICS NX, SOLIDWORKS.

THERMAL ENGINEERING LAB

Subject Code: 13ME3108 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To gain knowledge on the testing and performance of different IC engines.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Measure and draw valve and port timing diagrams on IC engines.
- Determine engine frictional power by motoring, retardation and Morse tests.
- Conduct economical speed test and heat balance test on an engine.
- Conduct performance tests on 4-stroke diesel, 2-stroke petrol engines.
- Conduct performance test on multi-stage reciprocating air compressor. Study various types of boilers with its mountings and accessories.

LIST OF EXPERIMENTS:

1. Valve Timing Diagram.
2. Port Timing Diagram.
3. Determination of Frictional Power by Retardation Test.
4. Determination of Frictional Power by Motoring Test.
5. Determination of Frictional Power by Morse Test.
6. Economical Speed Test.
7. Heat-Balance Sheet.
8. Performance Test on a 4-Stroke Diesel Engine.
9. Performance Test on a 2-Stroke Petrol Engine.
10. Performance Test on a Reciprocating Air Compressor.
11. Performance of Refrigeration Test Rig.
12. Performance of Air Conditioning Test Rig.
13. Study of Boilers.
14. Demonstration of Disassembly / Assembly of Engines.

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

MACHINE TOOLS LAB

Subject Code: 13ME3109 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To provide knowledge and hands on experience with various metal cutting machines.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Generate plain and tapered steps using turning operations on lathe machine.
- Develop threads and knurled surfaces by using lathe machine.
- Perform drilling, Tapping slotting, shaping, Planning operations using respective machines.
- Operate milling machine and produce various milled surfaces.
- Create smooth surface by using surface grinding machine.

LIST OF EXPERIMENTS:

1. Introduction of general purpose machines – Lathe, Drilling machine, Shaper, Planing machine, Slotting machine, Cylindrical Grinder, Surface grinder, Tool and Cutter grinder.
2. Step turning and taper turning on lathe machine.
3. Thread cutting and Knurling on lathe machine.
4. Drilling and Tapping.
5. Shaping and Planing.
6. Slotting.
7. Milling.
8. Cylindrical surface grinding.
9. Grinding tool angles.

SELF STUDY COURSE-II

Subject Code: 13ME3202 **Internal Marks: 75**
Credits: 1

COURSE OBJECTIVES:

- To identify sources of information.
- To collect relevant information.
- To interpret information.
- To move from problem to solution.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Select relevant information from various sources including internet, library, journals, papers, mechanical engineering magazines.
- Present advanced topics in mechanical engineering like modeling and simulation of mechanical systems, design and analysis of various components etc.
- Participate actively in group discussions related to mechanical or general engineering topics.

1. Data collection through internet related to mechanical engineering.
2. Data collection from library and other sources related to mechanical engineering.
3. Seminar presentation on advanced topics like modeling and simulation of different mechanical engineering systems, design and analysis of various components.
4. Group discussion related to mechanical engineering.

METROLOGY

Subject Code: 13ME3018 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide basic concepts of measurements by using different techniques.
- To provide basic knowledge on limits, fits and tolerances.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Calculate tolerances and allowances for different limits and fits.
- Determine linear and angular measurements by using various instruments. Design different kinds of go and no-go gauges.
- Compute various dimensions using optical measuring instruments. Perform flat surface measurements using optical flats and auto collimator.
- Assess surface roughness using CLA, Rt, RMS, Rz, and also by profilograph and talysurf instruments. Understand working principles of various mechanical, electrical, electronic, pneumatic comparators.
- Conduct screw thread and gear measurements, machine tool alignment tests.

UNIT-I

SYSTEMS OF LIMITS AND FITS:

Introduction, Normal size, Tolerance limits, Deviations, Allowance, Fits and their types, Unilateral and bilateral tolerance system, Hole and shaft basis systems, Interchangeability and selective assembly.
Indian Standard Institution System, British Standard System, International Standard System for plain and screwed work.

UNIT-II

CONCEPT OF MEASUREMENT:

General concept, Generalized measurement system, Units and standards, Measuring instruments.

LINEAR AND ANGULAR MEASUREMENT:

Definition of metrology.
Linear Measuring Instruments: Vernier, Micrometer – Interval measurement – Slip gauges and classification – Interferometry – Optical flats – Comparators: Mechanical, Pneumatic and Electrical types, Applications.
Angular Measuring Instruments: Sine bar, Optical bevel protractor, Angle decker – Taper measurements.

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:

Toolmaker's microscope and its uses – Collimators, Optical projector, Optical flats and their uses, interferometer.

FLAT SURFACE MEASUREMENTS:

Measurement of flat surfaces, Instruments used, Straight edges, Surface plates – Optical flat and Auto collimator.

UNIT-IV

SURFACE ROUGHNESS MEASUREMENT:

Differences between surface roughness and surface waviness – Numerical assessment of surface finish – CLA, R, R.M.S Values – Rz values, Methods of measurement of surface finish – Profilograph, Talysurf, ISI symbols for indication of surface finish.

MEASUREMENT THROUGH COMPARATORS:

Comparators: Mechanical, Electrical and Electronic, Pneumatic – Pneumatic comparators and their uses in mass production.

UNIT-V

SCREW THREAD MEASUREMENT:

Elements of measurement , Errors in screw threads, Measurement of effective diameter, Angle of thread and thread pitch, Profile thread gauges.

MACHINE TOOL ALIGNMENT TESTS:

Requirements of machine tool alignment tests, Alignment tests on lathe, milling, drilling machine tools.

GEAR MEASUREMENT:

Gear measuring instruments, Gear tooth profile measurement, Measurement of diameter, Pitch pressure angle and tooth thickness.

COORDINATE MEASURING MACHINES:

Types of CMM, Role of CMM, Applications of CMM.

TEXT BOOKS:

1. Engineering Metrology, I C Gupta, Dhanpat Rai Pub.
2. Engineering Metrology, R.K. Jain, Khanna Pub.

REFERENCES BOOKS:

1. Engineering Metrology, Mahajan, Dhanpat Rai Pub.
2. Dimensional Metrology, Connie Dotson, Cengage Pub.
3. A Text Book of Production Engineering, P.C. Sharma, S. Chand Pub.
4. Precision Engineering in Manufacturing, R.L. Murthy, New Age Pub.

INSTRUMENTATION AND CONTROL SYSTEMS

Subject Code: 13EI3002 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To introduce measurement system and classification.
- To deal with analysis of errors in measurement system.
- To introduces characteristics and response of transducers.
- To introduce resistive transducers, reactance variation sensors and their signal conditioning.
- To deal with measurement of non-electrical quantities using sensors.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Define basic principles of measurement systems, and describe dynamic performance characteristics and sources of error. Describe various pressure measuring instruments.
- Explain various stress, strain, temperature and flow measuring instruments.
- Explain various displacement, acceleration, force, torque, power and speed measuring instruments.
- Design control systems using time-domain analysis techniques like pole placement, root locus and Routh-Hurwitz criterion.
- Design control systems using frequency-domain analysis techniques like Nyquist, Bode plots. Design PID controllers.

UNIT-I

INTRODUCTION:

Basic principles and functional descriptions of measuring instruments with examples – Dynamic performance characteristics, Sources of error and their classification, Elimination of errors.

PRESSURE:

Classification of pressure gauges according to range of operation – Principles and working of manometers, Bourdon tubes, Bellows, Diaphragm gauges. Low pressure measurement: Thermal conductivity type gauges, Ionization type pressure gauges, McLeod pressure gauge – Various Calibration techniques.

UNIT-II

STRESS AND STRAIN:

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.

TEMPERATURE:

Classification according to principle of operation and range of temperature measurement techniques: Expansion, Resistive, Pyrometers, Thermocouples.

FLOW:

Rotameter, Magnetic flow meter, Ultrasonic flow meters, Turbine flow meter, Hot-wire anemometer.

UNIT-III

MEASUREMENT OF DISPLACEMENT:

Theory and construction of various transducers to measure displacement: Inductive, Capacitive, Resistive Transducers.

MEASUREMENT OF ACCELERATION:
Different simple instruments, Principles of Seismic instruments, Vibrometer and accelerometer using this principle.

FORCE, TORQUE, POWER AND SPEED:
Elastic force meters, Load cells, Torsion meters, Dynamometers, Stroboscope.

UNIT-IV
ELEMENTS OF CONTROL SYSTEMS:
Introduction, Importance, Classification, Open and closed systems.

TIME-DOMAIN ANALYSIS OF CONTROL SYSTEMS:
Time-domain performance of first order and second order systems with poles and zeros – Effects of addition of poles and zeros to transfer functions – Dominant poles of transfer functions – Stability of control systems using Routh-Hurwitz criterion – Introduction to Root Locus technique.

UNIT – V
FREQUENCY-DOMAIN ANALYSIS OF CONTROL SYSTEMS:
Nyquist stability criterion, Application of the Nyquist criterion – Stability of linear control systems with time delays – Frequency-domain characteristics: M_{p1}, W_p and bandwidth of a second-order system. Relative stability: Gain margin, Phase margin – P, PI, PID Control Algorithms.

TEXT BOOKS:
1. Measurement Systems: Application and Design, D.S. Kumar, S.K. Kataria & Sons Pub.
2. Control Systems Engineering, I.J. Nagrath, M. Gopal, New Age Pub.

REFERENCES BOOKS:
1. Measurement systems: Application and design, Earnest. O. Doeblin, Adaptation by Manik and Dhanesh, Tata McGraw Hill Pub.
2. Mechanical and Industrial Measurements, R.K. Jain, Khanna Pub.
3. Control Systems Engineering, Norman S. Nise, Wiley Student Edition Pub.
4. A Course in Electrical & Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai Pub.

INDUSTRIAL ENGINEERING AND MANAGEMENT

Subject Code: 13ME3019 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide basic knowledge on organizational structures.
- To provide knowledge on work study, method study, objectives and steps involved in them.
- To provide knowledge on inspection and quality control, types of inspections and statistical quality control techniques.

COURSE OUTCOMES:

On completion of this course, students should be able

- Explain the merits, demerits and suitability of different kinds of organizational structures.
- Explore the differences between different types of layouts and production methods. Select the most suitable combination of layout and method that brings efficiency in operations.
- Perform work study and work measurement involving work sampling along with motion and time studies on different tasks.
- Conduct inventory analysis like ABC, VED and understand the different tasks involved in purchase and materials management.
- Apply statistical quality control tools and follow total quality management procedures to attain quality standards.

UNIT-I

DESIGNING ORGANISATIONAL STRUCTURES:

Basic concepts related to organization: Departmentation and Decentralisation – Types of mechanistic and organic structures of organization: Line organization, Line and staff organization, Functional organization, Committee organization, Matrix organization, Virtual organization, Cellular organization – Team structure, Boundaryless organization, Inverted pyramid structure – Lean and flat organization structure and their merits, demerits and suitability.

UNIT-II

PLANT LAYOUT:

Plant Location: Definition, Factors affecting plant location, Comparison of rural and urban sites – Methods for selection of plant: Matrix approach.

Plant Layout: Definition, Objectives, Types of production, Types of plant layout – Various data analyzing forms, Travel chart.

UNIT-III

WORK STUDY:

Work Study: Definition, Objectives – Method study: Definition, Objectives, Steps involved – Various types of associated charts – Difference between micro-motion and memo-motion studies.

Work Measurement: Definition, Time study, Steps involved, Equipment – Different methods of performance rating: Allowances, Standard time calculation.

Work Sampling: Definition, Steps involved, Standard time calculations, Differences with time study.

UNIT-IV

MATERIALS MANAGEMENT:

Objectives, Inventory: Functions, Types, Associated costs – Inventory classification techniques: ABC, VED analysis – Inventory Control Systems: Continuous review system, periodical review system – Stores Management and Stores Records – Purchase management, Duties of purchase manager, Associated forms.

UNIT-V

QUALITY MANAGEMENT:

Inspection and quality control, Types of inspections – Statistical Quality Control techniques, Variables and Attributes, Assignable and non-assignable causes – Variable control charts, R charts, Attributes control charts, p-charts, c-charts – Acceptance sampling plan: Single sampling, Double sampling plans, OC curves. – Introduction to TQM, Quality Circles, ISO 9000 Series procedures.

TEXT BOOKS:

1. Manufacturing Organization and Management, Harold T. Amrine, John A. Ritchey, Colin L. Moodie, Joseph F. Kmec, Pearson Pub.
2. Industrial Engineering and Management, O.P. Khanna, Dhanpat Rai Pub.

REFERENCES BOOKS:

1. Management, James Arthur Finch Stoner, R. Edward Freeman, Daniel R. Gilbert, Pearson Pub.
2. Production and Operations Management, Panner Selvam, Prentice Hall India Pub.
3. Reliability Engineering & Quality Engineering, C. Nadha Muni Reddy, K. Vijaya Kumar Reddy, Galgotia Pub.
4. Operations Management, Richard B Chase, F Robert Jacobs, Nicholas J Aquilano, Nitin K Agarwal, Tata McGraw Hill Pub.

III Year B. Tech., II Semester

HEAT TRANSFER

Subject Code: 13ME3020 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide knowledge on modes of heat transfer like conduction, convection and radiation.
- To provide knowledge on different coordinate systems used in heat transfer.
- To provide knowledge on emissivity and absorbvity.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Derive general heat conduction equation in cartesian, cylindrical and spherical coordinates. Determine heat conducted through both simple and composite plane walls, cylinders and spheres.
- Determine heat conducted through simple shapes with internal heat generation, and through various kinds of fins. Determine transient unsteady temperature distribution for simple shapes using Heisler charts.
- Determine heat convected in forced convection of both external and internal flows, laminar and turbulent flows, over plates, cylinders, spheres and tube banks.
- Determine heat convected in natural convection for flow over a plate. Understand and solve problems in pool boiling and condensation. Perform heat exchanger analysis and design using LMTD and NTU methods.
- Apply various radiation laws, computer shape factors for simple configurations, use electrical analogy for radiation problems and design radiation shields.

UNIT-I

CONDUCTION:

Basic concepts, Mechanisms of heat transfer: Conduction, Convection, Radiation – Fourier law of conduction – General differential equation of heat conduction in cartesian and cylindrical coordinates – One dimensional steady state heat conduction – Conduction through plane walls, cylinders and spherical systems – Composite systems.

UNIT-II

CONDUCTION:

Conduction with internal heat generation – Extended surfaces – Unsteady heat conduction Lumped analysis – Use of Heislers chart.

UNIT-III

FORCED CONVECTION:

Basic Concepts, Heat transfer coefficients, Types of convection – Dimensional analysis – Boundary layer concept –Forced convection of external flows, flow over plates, cylinders and spheres – Internal flows, Laminar, Turbulent, Combined laminar and turbulent – Flow over bank of tubes.

UNIT-IV

NATURAL CONVECTION:

Free convection, Flow over Vertical plate, Horizontal plate, Inclined plate, Cylinders and Spheres.

BOILING & CONDENSATION:

Boiling, Pool boiling, Regimes of pool boiling – Flow boiling.
Nusselts theory of condensation – Correlations in boiling and condensation

HEAT EXCHANGERS:

Types of heat exchangers – Heat exchanger analysis: LMTD method, NTU Effectiveness method – Overall heat transfer coefficient, Fouling factor.

UNIT-V

RADIATION:

Basic concepts, Laws of radiation: Stefan-Boltzman law, Kirchoffs law – Black body radiation, Grey body radiation – Shape factor algebra, Electrical analogy – Radiation Shields – Introduction to gas radiation.

TEXT BOOKS:

1. Heat Transfer, R.K. Rajput, S. Chand Pub.
2. Fundamentals of Engineering Heat and Mass Transfer, R.C. Sachdeva, New Age Pub.
3. Heat Transfer Databook, C.P. Kothandaraman, New Age Pub. (**Permitted for Exams**

REFERENCES BOOKS:

1. Heat Transfer, P.K. Nag, Tata McGraw Hill Pub.
2. A Course in Heat & Mass Transfer, S.C. Arora, S. Domkundwar, A.V. Domkundwar, Dhanpat Rai Pub.
3. Heat Transfer, Yunus A Cengel, McGraw Hill Pub.
4. Heat Transfer, J.P. Holman, McGraw Hill Pub.

OPERATIONS RESEARCH

Subject Code: 13ME3021 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand linear programming problem formulation, graphical and simplex solutions.
- To provide knowledge about the formulation of optimal solution at transportation, assignment and queuing problems.
- To provide knowledge on Project network, CPM and PERT network.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Formulate, solve linear programming problem using graphical and simplex method along with its Big-M and 2-Phase variations.
- Solve both balanced and unbalanced transportation and assignment problems.
- Solve sequencing problems with n-jobs & m-machines. Compute queue performance characteristics for various queuing models.
- Solve replacement and game theory problems by applying standard solution methods.
- Calculate critical path for a given network using PERT and CPM techniques.

UNIT-I

INTRODUCTION TO OR:

History, Definition, OR models, OR Techniques, Phases of implementing OR in practice.

LINEAR PROGRAMMING:

Introduction to linear programming problem formulation, Graphical solution, Simplex method, Artificial variables techniques, Unrestricted variables, Degeneracy.

UNIT-II

TRANSPORTATION PROBLEM:

Formulation, Optimal solution, Unbalanced transportation problems, Degeneracy.

ASSIGNMENT PROBLEM:

Formulation, Optimal solution, Traveling salesman problem.

UNIT-III

SEQUENCING:

Introduction, Problems with *n* jobs and two machines, Optimal sequence algorithm, Problems with *n* jobs and three machines, Problems with n- jobs and m- machines (graphic solution.

QUEUING THEORY:

Characteristics of Queuing models, Classification, (M/M/1:(FCFS/∞/∞, (M/M/1:(FCFS/N/∞, (M/M/C:(FCFS/∞/∞ models.

UNIT-IV

REPLACEMENT:

Introduction, Replacement of items that deteriorate with time, Value of money unchanging and changing, Replacement of items that fail completely.

THEORY OF GAMES:
Introduction, Two-person Zero-sum games, Maximum-Minimax principle, Games without saddle points, Mixed Strategies, m x 2 & 2 x n games, Graphical solutions, Dominance property, Algebraic solutions to rectangular games.

UNIT-V
NETWORK MODELS:
Project network, CPM and PERT, Critical path scheduling, Cost considerations in project scheduling.

TEXT BOOKS:
1. Introduction to Operations Research by Prem Kumar Gupta, D.S. Hira, S. Chand Publishers
2. Operations Research, S.D.Sharma, Kedarnath Ramanadh Pub.

REFERENCES BOOKS:
1. Operations Research, J.K. Sharma, MacMilan Pub.
2. Operations Research by P. Rama Murthy, New Age Pub.
3. CPM & PERT, L.S. Srinath, Affiliated East West Press Pub.

TOOL DESIGN
(Elective –I)

Subject Code: 13ME3022 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To gain knowledge on designing of various cutting tools.
- To gain knowledge on designing of jigs and fixtures.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Explain unconventional machining processes and super-finishing processes.
- Design single and multi-point cutting tools.
- Design twist drills and reamers.
- Design press tools including die-sets and plastic tools.
- Design jigs and fixtures for various machine tool operations.

UNIT-I

Classification and coding of carbide tools, Coated tools

Unconventional Machining Processes: Principles of working and applications of USM, EDM, ECM, AJM, LBM, and EBM

Super-finishing Processes: Honing, Lapping Burnishing, Ballizing, Polishing.

UNIT-II

Design of Single-Point Cutting Tools: Form Tools, Design of flat and circular form tools, Tool holding methods.

Design of Multi-Point Cutting Tools: Milling Cutters: Major types, design and manufacturing of peripheral, end and face milling cutters, forces and power estimation, grinding of milling cutters.

Broaches: Pull and Push types. Internal and External broaches, geometry and design and manufacturing of pull type and push type broaches.

UNIT-III

Drills: Twist drill geometry, Design and manufacturing of twist drill – Effect of variation of different angles on torque and thrust forces – Types and design of shanks – Sharpening of twist drill, Design and manufacture of twist drills.

Reamers: Types, Geometry, Reaming allowance, Tolerance disposition.

UNIT-IV

Design of Press Tools: Die set elements – Design of die set for simple components in Blanking, Piercing, Bending, Drawing, Forging and Spinning.

Plastic Tools: Plastic dies for simple components.

UNIT-V

Jigs & Fixtures: Design principles and constructional features – Locating methods associated with flat, cylindrical, internal and external surfaces, Types of locating pins, Requirements and choice of locating systems, Redundant location, Fool proofing – Setting blocks, Types of clamping devices and their basic elements, Quick action clamps and nuts.

TEXT BOOKS:

1. Tool Design, Cyril Donaldson, V. C. Goold, Tata McGraw Hill Pub.
2. Production Engineering Design (Tool Design, Surender Keshav, Umesh Chandra, Satya Prakashan Pub.

REFERENCES BOOKS:

1. Design of Cutting Tools, Rodin, Mir Publications, Moscow.
2. Design of Cutting Tool, Use of Metal Cutting Theory, Amitabha Bhattacharya, Inyong Ham, ASTME Pub.

DATABASE MANAGEMENT SYSTEM
(Elective –I)

Subject Code: 13ME3023 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide a sound introduction to DBMS.
- To present SQL and Procedural interfaces to SQL comprehensively.
- To give an introduction to Systematic Database Design.
- To present the concepts and techniques relating to query processing.
- To introduce the concepts of transactions and transaction processing.
- To present the issues and techniques relating to concurrency and recovery in multiuser database environments.
  To introduce various data structures for external data strage.

COURSE OUTCOMES:

- Recognize the advantages and applications of DBMS.
- Design and implement a database schema for a given problem-domain.
- Construct queries using SQL to retrieve required information from database.
- Use normalization techniques on given database design to avoid anomalies.
- Summarize concurrent executions, serializability, recoverability of transaction**s.**
- Identify database recovery techniques in case of failures.

UNIT-I

Database System Applications, Database System VS file System- View of Data- Data Abstraction- Instances and Schemas- Data Models-The ER Model-Relational Mode-Other Models – Database Languages-DDL-DML – Database access for applications programs – Database users and administrator – Transaction management – Database system structure- Storage manage- Query processor.

UNIT-II

History of Database Systems, Database design and ER diagrams- Beyond ER design entities, Attributes and entity sets- Relationships and Relationship sets – Additional features of ER model- Concept design with the ER model- Conceptual design for large enterprises.

Introduction to the Relational Model – Integrity Constraint Over relations-Enforcing Integrity constraints – Querying relational data-Logical data base Design-Introduction to Views-Destroying/altering tables and views. Relational algebra – Selection and projection set operations-Renaming-Joins, Division.

UNIT-III

Form of Basic SQL Query- Examples of Basic SQL Querie-Introduction to Nested Queries-Correlated Nested Queries Set – Comparison Operators-Aggregative Operators – NULL values- Comparison using Null values- Logical connectivity's- AND- OR and NOT – Impact on SQL Constructs- Outer Joins- Disallowing NULL values- Complex Integrity Constraints in SQL Triggers and Active Databases.

UNIT-IV

Schema refinement, Problems caused by redundancy – Decompositions- Problem related to decomposition – Reasoning about FDS – First, Second, Third Normal forms-BCNF – Lossless join decomposition-Dependency preserving decomposition – Schema refinement in Database Design- Multi-valued Dependencies- Fourth Normal Form.

Transaction Concept-Transaction State-Implementation of Atomicity and Durability-Concurrent Executions – Serializability-Recoverability-Implementation of Isolation – Testing for serializability-Lock-Based Protocols-Timestamp Based Protocols-Validation Based Protocols–Multiple Granularity.

UNIT-V

Recovery and Atomicity-Log based recovery- Recovery with concurrent transactions – Buffer Management-Failure with loss of nonvolatile storage – Advanced Recovery systems-Remote Backup systems. Data on external storage – File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexe- Index data structures-Hash based indexing-Tree base Indexing-Comparison of File Organizations-Indexes and performance tuning – Intuitions for tree indexes – Indexed Sequential Access Methods (ISAM – B+ Trees: Dynamic index structure. Introduction to database security and authorization, access control, discretionary access control, mandatory access control, security applications.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3/e Tata McGraw Hill Pub.
2. Database System Concepts, Silberschatz, F. Korth, 5/e McGraw Hill Pub.

REFERENCES BOOKS:

1. https:// www.coursera.org/course/db
2. Database Systems Design, Design, Implementation and Management, peter Robo & Carlos Coronel 7th Edition.
3. Fundamentals of Database Systems, Elmasri, Navathe, Pearson Pub.
4. Introduction to Database Systems, C. J. Date, Pearson Education.

CONDITION MONITORING & MAINTENANCE ENGINEERING
(Elective –I)

Subject Code: 13ME3024 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide knowledge on maintenance types and quality circle in maintenance.
- To provide knowledge on fault diagnosis and vibration analysis.
- To understand various condition monitoring techniques.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Describe various types of maintenance.
- Understand how vibration fault diagnosis is used for imbalance, misalignment, looseness, resonance detection.
- Understand vibration measurement and analysis using time and frequency domain techniques.
- Discuss thermography and develop an ability to interpret thermal images. Explain the principles of lubrication oil analysis (chemical, contamination and wear particles.
- Describe methods for ultrasonic monitoring, analysis and inspection.

UNIT-I

MAINTENANCE ENGINEERING:

Quality circle in maintenance – Maintenance Types: Breakdown, Corrective, Opportunity, Routine, Preventive and predictive, Condition based systems, Designout.

UNIT-II

FAULT DIAGNOSIS:

Fault Diagnosis, Interpreting vibration measurements for common machine faults, Imbalance, Misalignment, Mechanical looseness, Bearing and gearing faults, Faults in induction motors, Resonances, Case studies, Static and dynamic balancing, International standards for vibration condition monitoring.

UNIT-III

VIBRATION MEASUREMENT 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.

UNIT-IV

THERMOGRAPHY:

Basics of infrared thermography, Differences in equipment, Specific wavelength limitations, Application of IR: Electrical inspection, Mechanical inspection, Energy conversion – How to take good thermal images.

OIL AND WEAR DEBRIS ANALYSIS:

Basis of oil analysis, Monitoring condition of oil, Lubricant analysis, Phyio-chemical properties, Moisture, TAN TBN, Wear debris analysis, Particle counting, Spectroscopy, Uses and limitations, Ferrography wear particle analysis, Concept of ferrography.

UNIT-V

ULTRASONIC:

Ultrasonic Monitoring: leak, crack, thickness – Basics of ultrasonic monitoring, Ultrasonic theory, Test taking philosophy, 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: Air leaks, Stream trap testing, Bearing lubrication, Electrical inspection, Case studies.

TEXT BOOKS:

1. Mechanical Fault Diagnosis and Condition Monitoring, R.A. Collacott, Springer Pub.
2. Management of Industrial Maintenance, Newman-Butterworth

REFERENCES BOOKS:

1. Maintenance Engineering Handbook, Lindley R Higgins, Darrin J Wikoff, R. Keith (Mobley Editor in Chief, McGraw Hill Pub.
2. Vibration Monitoring Handbook, Coxmoor's Machine & System Conditioning Monitoring, Coxmoor Pub
3. Machinery Vibration: Measurement and Analysis, Victor Wowk, McGraw Hill Pub.
4. Condition Monitoring Manual, National Productivity Council, New Delhi

AUTOMOBILE ENGINEERING
(Elective –I)

Subject Code: 13ME3025 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To provide broad knowledge about the engine, transmission, braking system, steering, suspension and electrical subsystems of an automobile.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Explain construction and operation of components of engine and its lubrication system, along with engine specifications, service procedures.
- Explain the operation of the components involved in both carburetor based and direct fuel injection based fuel systems.
- Explain the working of components involved in the cooling system. Describe the mechanism of distributor-based and electronic ignition systems.
- Explain mechanism of starting and charging electrical systems, and electrical accessories. Discuss construction and operation of transmission system components including clutch, gearbox, propeller shaft, differential, axles, wheels and tires.
- Explain construction and operation of steering, suspension and braking system components.

UNIT-I

INTRODUCTION:

Components of four wheeler automobile – Power transmission – Rear wheel drive, front wheel drive, 4 wheel drive – Types of automobile engines, turbo charging and super charging – Engine lubrication: Splash, Pressure lubrication systems, Oil filters, Oil pumps – Crank case ventilation, Emission from Automobiles, Pollution standards: National and International, Pollution control techniques – Multipoint fuel injection for SI Engines.

UNIT-II

FUEL SYSTEM:

S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump, fuel filters – Carburetor, Types – Air filters – Petrol injection.

C.I. ENGINES:

Requirements of diesel injection systems, Types of injection systems, Fuel pump, Nozzle, Spray formation, Injection timing, Testing of fuel pumps.

UNIT-III

COOLING SYSTEM:

Cooling requirements, Air cooling, Liquid cooling – Thermo, Water and Forced Circulation System – Radiators, Types – Cooling Fan, Water pump, Thermostat, Evaporating cooling, Pressure sealed cooling – Antifreeze solutions.

IGNITION SYSTEM:

Function of ignition system – Battery ignition system: Constructional features of storage battery, Auto transformer, Contact breaker points, Condenser and spark plug – Magneto coil ignition system – Electronic ignition system using contact breaker, Electronic ignition using contact triggers – Spark advance and retard mechanisms.

UNIT-IV

ELECTRICAL SYSTEM:

Charging circuit, Generator, Current regulator, Voltage regulator – Starting system: Bendix drive mechanism, Solenoid switch – Lighting systems, Horn, Wiper, Fuel gauge, Oil pressure gauge, Engine temperature indicator.

TRANSMISSION SYSTEM:

Clutches, Principle, Types, Cone clutch, Single plate clutch, Multi plate clutch, Magnetic and centrifugal clutches, Fluid flywheel – Gear box, Types: Sliding mesh, Constant mesh, Synchro mesh, epicyclic – Overdrive torque converter – Propeller shaft – Hotch-Kiss drive, Torque-tube drive – Universal joint, Differential rear axles types – Wheels and tires.

UNIT-V

STEERING SYSTEM:

Steering geometry: Camber, Castor, King pin rake, Combined angle toe in – Center point steering – Types of steering mechanism : Ackerman, Davis – Steering gears, Types – Steering linkages.

SUSPENSION SYSTEM:

Objects of suspension systems – Rigid axle suspension system – Torsion bar, Shock absorber – Independent suspension system.

BRAKING SYSTEM:

Mechanical braking system – Hydraulic brake system: Master cylinder, Wheel cylinder, Tandem master cylinder, Requirement of brake fluid, Pneumatic and vacuum brakes.

TEXT BOOKS:

1. Automotive Mechanics Vol-I&II, Kripal Singh, Standard Pub.
2. Automobile Engineering, William H Crouse, Donald L Anglin, McGraw Hill Pub.

REFERENCES BOOKS:

1. Automotive Technology: Principles, Diagnosis, and Service, James D. Halderman, Pearson Pub.
2. Automotive Mechanics, G.B.S. Narang, Khanna Pub.
3. Automotive Mechanics, Joseph Heitner, Van Nostrand Reinhold Pub.

METROLOGY AND INSTRUMENTATION LAB

Subject Code: 13ME3110 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

METROLOGY LAB

COURSE OBJECTIVES:

- To provide basic concepts of measurements by using different techniques.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Measure length, diameter, bore, angle, taper, flatness using various instruments.
- Measure gears and thread by mechanical methods. Use toolmakers microscope for optical measurements.
- Conduct machine tool alignment test on lathe and milling machine.
- Measure pressure, temperature, using various instruments.
- Measuring using capacitive transducers, LVDT, stroboscope.

LIST OF EXPERIMENTS:

1. Measurement of lengths, heights, diameters by vernier calipers micrometers.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking chordal addendum and chordal height of spur gear.
4. Machine tool alignment of test on the lathe.
5. Machine tool alignment test on milling machine.
6. Tool makers microscope and its application.
7. Angle and taper measurements by Bevel protractor, Sine bars.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by two-wire and three-wire method or tool-makers microscope.

INSTRUMENTATION LAB

COURSE OBJECTIVES:

- To provide basic knowledge on mechanism of an instrument.
- To provide knowledge on controlling different instruments.

COURSE OUTCOMES:

On completion of this course, students should be able

- To get knowledge on mechanisms of an instrument
- To get working knowledge of different instruments.

LIST OF EXPERIMENTS:

1. RPM indicator using stroboscope.
2. Bourdon tube pressure gauge.
3. Capacitive transducer.
4. LVDT.
5. RTD (Temperature measurement
6. Temperature control loop

PRODUCTION DRAWING PRACTICE

Subject Code: 13ME3111 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To provide knowledge on conventional representation of materials, parts, tolerances, surface treatment and roughness on drawings.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Draw individual part drawings from the given assembly drawing.
- Represent dimensional and geometrical tolerances on part drawings.
- Represent surface finish data on part drawings.
- Fill up process sheet for a given component.
- Draw production drawing of an assembly using CAD software.

1. INTRODUCTION AND DRAWING OF COMPONENT:

Need of preparing a production drawing, Requirements for manufacturing a product like equipment, Tools, Measuring instruments depending upon processes, Accuracy and finish data available in machine drawing – Components of a production drawing, Fits and tolerances, Surface finish, Specific processes, Material of the component.

Read a given assembly drawing – study of functions of the various parts of the assembly drawing.

Preparation of detailed drawing of a specified part of the assembly.

2. LIMITS, FITS AND TOLERANCES:

Definitions of limits, fits and tolerances.

Select dimensions from BIS standards to obtain clearance, Transition and interference fits for a given set to mating parts – Computation of fit and tolerance from BIS table.

Preparation of drawing of mating parts and representation of fits and tolerances.

Exercises in computing tolerance and representation on the drawings for different types of fits.

3. GEOMETRICAL TOLERANCES:

Importance of geometrical tolerances, Types of geometrical tolerances.

Tolerance of form: Straightness, Flatness, Roundness, Cylindricity.

Tolerance of profile: Profile of a line, Profile of a surface.

Tolerance of orientation or attitude: Angularity, Perpendicularity, Parallelism.

Tolerance of location: Position, Concentricity, Symmetry.

Composite tolerances: Radial run-out, Axial run-out

Symbols for geometrical tolerances, Indication of geometrical tolerances on components.

Exercises on representation of geometrical tolerances on the drawings.

4. SURFACE FINISH:

Standard symbol of surface finish and indications added to it.

Representation of quality of surface finish on the drawing as BIS roughness grade numbers.

Exercises on specifying surface roughness (average values for functional surfaces of the following machine tool parts:

-Shaft rotating in bush bearing
-Tailstock sleeve in tailstock body
-Keys and keyways
-Mounting surfaces for antifriction bearings
-Shaft or bush press fitted into bodies
-Beds of machine tools, guide-ways
-Contact surfaces, for example, flanges of pipe fittings
-Peripheral surfaces of pulleys and grooves for v-belts
-Surfaces of control elements, for example, levers, hand wheels
-Bases of machines
-Machine tool tables

5. SPECIFICATION OF STANDARD PARTS:

Standard components (parts are to be designated as per BIS
-Bolts, nuts, locknuts, washers, screws and studs
-Circlips
-Cylindrical and taper pins
-Keys
-Rivets
-Splines
-Oil seals-rings
-Antifriction bearings

6. PROCESS SHEETS:

(i Sequence of processes of production for a particular product.
(ii Specifications of relevant equipment and tools to obtain the desired accuracy and surface finish.
(iii Selection of measuring instruments to check the accuracy.

7. PRODUCTION DRAWING EXERCISES:

(i Prepare relevant views of the part(s of a given assembly drawing needed for production.
(ii Dimension the views obtained and indicate on it with relevant notes the specific processes.
(iii Compute the fit from ISI tables as per the function of the component and indicate the limits at appropriate place on the drawing prepared.
(iv Indicate the geometrical tolerances on the component drawing.
(v Mark the surface finish symbols with indications added.
(vi Prepare the process sheet indicating sequence of processes and equipment, tools, measuring instruments required.

LIST OF DRAWINGS

1. Knuckle Joint
2. Eccentric
3. Lathe tail stock
4. Stuffing box

Note: Any 1 should be drawn in CAD Software.

TEXT BOOKS:

1. Production and Drawing, K.L. Narayana, P. Kannaiah, K. Venkat Reddy, New Age Pub.
2. Machine Drawing, N. Sidheswar, P. Kanniah, V. V. S Sastry, Tata McGraw Hill Pub.

INTELLECTUAL PROPERTY RIGHTS AND PATENTS

Subject Code: 13HS3202
Credits: 0

COURSE OBJECTIVES:

- To learn the evolutionary process leading to intellectual property law.
- To learn cyber laws.
- To learn about trade related intellectual property rights.
- To learn the necessity for trademarks.
- To learn copyright law.
- To learn about trade secrets.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Explain evolution of intellectual property law. Acquire details regarding components of TRIPS.
- Generate an application after searching for obtaining a patent. Outline consequences of patent infringement.
- Comprehend the evolution of copyright act, the rights it confers and remedies in case of infringement.
- Determine the necessity of trademark law, its process and rights that it confers.
- Recognize that trade secrets are a necessary component of industrial trade. Recognize that secrets can be divulged by employees under contract. Discuss transactional law and how it creates wealth and also risk in the high technology sector.

UNIT-I

Introduction to intellectual property law, Types of intellectual property, Evolution of human intellectual effort as property, Agencies responsible for registration of intellectual property, Preparatory legal tasks in intellectual property law, Introduction to cyber law, Cyber crime and E-commerce, International aspects of computer and online crime, Trade related intellectual property rights.

UNIT-II

Introduction to patent law, International patent law, Necessity of patents, Rights and limitations, Patent Application Process, Patent search, Patent law treaty, New developments in patent law, What is considered as an invention, Rights under patent law, Ownership, Transfer of patents, Patent infringement, Patent Litigation, Double-Patenting.

UNIT-III

Introduction to Copyrights, Copyright principles, Subject matter of Copyright, Rights afforded by copyright law, Copyright ownership, Transfer and duration, Right to prepare derivative works, Rights of distribution. Copyright formalities and registrations, Limitations, Copyright disputes and international copyright law, Semiconductor chip protection act.

UNIT-IV

Introduction to Trademark, Trademark registration process, Post registration procedures, Trademark maintenance, Transfer of Rights, Inter-parties proceedings, Infringement, Dilution of ownership, Trademark claims, Trademark litigation, International Trademark Law.

UNIT-V

Introduction to trade secrets, Maintenance of trade secrets, Physical security, Employee confidentiality agreement, Trade secret law, Unfair competition, Trade secret litigation, Introduction to transactional law, Breach of contract, Creating wealth and managing Risk, Business assets in information age, Symbols and trademarks, Trolls and landmines.

TEXT BOOKS:

1. Intellectual Property Law in India, Justice P S Narayana, Jain Book Depot Pub.
2. Intellectual Property Law, Gade Veera Reddy, Sujata Law Books Pub.

REFERENCES BOOKS:

1. Intellectual Property, Deborah E.Bouchoux, Cengage Pub.
2. Fundamentals of IPR for Engineers, Kompal Bansal, Parishit Bansal, BS Pub.
3. Intellectual Property Rights, Prabhuddha Ganguli, Tata McGraw Hill Pub.
4. Intellectual Property, Richard Stim, Cengage Pub.

REFRIGERATION AND AIR CONDITIONING

Subject Code : 13ME4026 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To introduce the student to applications of Refrigeration and Air conditioning
- To expose the student to different cycles of Refrigeration such as ideal cycle of Refrigeration, Air Refrigeration cycle, vapour compression Refrigeration cycle, vapour absorption refrigeration
- To provide the students with a proper understanding of Thermoelectric Refrigeration and Vortex tube Refrigeration
- To have an overview of psychrometric processes used in air conditioning
- To provide knowledge on load concepts of RSHF, GSHF, ESHF and ADP

COURSE OUTCOMES:

On completion of this course, students should be able to

- Perform thermodynamic analysis on various refrigeration cycles like Bell-Coleman cycle and Brayton cycle.
- Describe components and analyze COP of vapor compression cycles including sub-cooling and super-heating. Explain the working of condensers, refrigerants, evaporator and expansion devices.
- Describe components and analyze COP of vapor absorption cycles. Explain the working of essential components of vapor absorption refrigeration.
- Explain the working principles of non-conventional refrigeration systems like thermo-electric, vortex-tube and pulse tube refrigeration systems.
- Solve problems based on RSHF, GSHF, ESHF and ADP. Calculate air-conditioning cooling load.

UNIT-I:

Introduction to Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P – Mechanical Refrigeration – Types of ideal cycle of refrigeration.

Air Refrigeration : Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system – Refrigeration needs of Air crafts air systems – Actual air refrigeration system problems – Refrigeration needs of Air Crafts

UNIT-II:

Vapour Compression Refrigeration: – working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – Representation of cycle on T-S, P-h and h.s. charts – effect of sub cooling and super heating – cycle analysis – Actual cycle influence of various parameters on system performance – Use of p-h charts. Refrigerants – Desirable properties – common refrigerants used – Nomenclature.

UNIT-III:

Vapour Absorption System – Calculation of max COP – description and working of NH3 – water system – Li – Br system. Principle of operation three Fluid absorption system, salient features – Electrolux refrigerator. – working principle and essential components of the plant –vapour absorption refrigeration cycle – COP – Representation of cycle on T-S, P-h and h.s. charts

UNIT-IV:

Non-conventional Refrigeration System: Thermo electric refrigeration – advantages, disadvantages, applications. Vortex tube refrigeration: construction & working, advantages, disadvantages, applications. Pulse tube refrigeration: construction & working, advantages, dis advantages, applications.

UNIT-V:

Introduction to Air Conditioning: Psychometric Properties & Processes – characterization of Sensible and Latent heat loads and SHF – Need for Ventilation , infiltration – concepts of RSHF, GSHF, ESHF and ADP. Concept of human comfort and effective temperature – comfort Air conditioning - industrial air conditioning and Requirements – Air conditioning load calculations for simple application of a small room.

Air Conditioning Systems - classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers.

Text Books:

1. Refrigeration and Air Conditioning, CP Arora, Tata McGraw Hill Pub.
2. A Course in Refrigeration and Air Conditioning, CP Arora, Domukundwar, Dhanpatrai & Sons.

Reference Books:

1. Principles of Refrigerations, Dossat, Willey Eastern Pub.
2. Refrigeration and Air Conditioning, Manohar Prasad, New Age Pub.
3. Refrigeration and Air Conditioning, R.S. Khurmi, J.K. Gupta, S.Chand Pub.
4. .Refrigeration and Air Conditioning, P.L. Ballaney, Khanna Pub.

FINITE ELEMENT METHODS

Subject Code : 13ME4027 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand the fundamental relations of elasticity, basic concepts of variational approach and domain discretization.
- To derive element stiffness matrices for various finite element types and assemble the global stiffness matrix for calculating the nodal displacements, reaction forces, stresses and strains.
- To develop proficiency in the application of the finite element method to solve one dimensional and two dimensional problems.
- To obtain the natural frequencies and mode shapes for bars and beams using FEM.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Explain fundamental relations of elasticity, concepts of variational principles, basics of domain discretization using different types of elements, interpolation functions.
- Derive element stiffness matrices, assemble them for global stiffness matrix and solve system of linear equations to find displacements, reaction forces, strains and stresses.
- Analyze plane trusses and solve plane stress, plane strain problems using 2D CST elements.
- Analyze beams and 2D isoparametric problems with internal nodes using numerical integration procedures.
- Evaluate Eigen values and Eigen vectors for both consistent and lumped mass matrix approaches for1D bar and beam elements. Solve composite slab and 1D fin problems on steady state heat transfer using FEA.

UNIT-I

Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, Basic Steps in FEM Formulation, General Applicability of the Method; Variational Functional, Rayleigh-Ritz method, concept of potential energy, Derivation of Elemental Equations, Imposition of Boundary Conditions, Solution of the Equations.

UNIT- II

Finite Element Modeling: Discretization of domain, element shapes, node numbering, Coordinates and shape functions, assembly of stiffness matrix and load vector, band width, Potential energy approach, Galerkin's approach, Finite element equations, elimination and penalty methods, stress, strain and support reaction calculations, Applications to 1-D bar elements and Temperature effects, Applications to Quadratic bar elements.

UNIT- III

Plane Trusses: Finite element modeling - Discretization of domain, local and global numbering scheme, Finite element equations and solution.

Two-dimensional Problems Using Constant Strain Triangles: Introduction, Finite element modeling, constant strain triangle, problem modeling and boundary conditions.

UNIT-IV

Analysis of Beams: Introduction, Finite element formulation using 2D Hermite beam element, derivation of stiffness matrices, derivation of load vector for concentrated and UDL, Boundary considerations, Shear force and bending moment calculations.

Two-dimensional Isoparametric Elements and Numerical Integration: Introduction to Higher order and isoparametric elements - four-noded quadrilateral, Numerical integration & Gaussian Quadrature.

UNIT-V

Dynamic Considerations: Introduction, formulation, element consistent & lumped mass matrices, evaluation of Eigen values and Eigen vectors, Mode Shapes, Free Vibration Problems of 1D stepped bar and 2D beam with reduced matrix of order 2x2.

Steady State Heat Transfer Analysis: One dimensional analysis of a composite slab and fin

Introduction to Computer Implementation using FEA Packages: Pre-processor, Processor/Solution & Post Processor using ANSYS/NASTRAN.

Text Books:

1. Introduction to Finite Elements in Engineering, T.R. Chandraputla, Ashok. D. Belegundu, Pearson Education Pub.
2. Textbook of Finite Element Analysis, P. Seshu, Prentice-Hall Pub.
3. Finite Element Methods, Basic Concepts and Applications, Chennakesava R Alavala, PHI Pub.

Reference Books:

1. Concepts and Applications of Finite Element Analysis, Robert D. Cook, Wiley Pub.
2. The Finite Element Methods in Engineering, S.S. Rao, Pergamon Pub.
3. An Introduction to the Finite element method, J.N. Reddy, Tata McGraw Hill Pub.
4. Finite Element Method and Computational Structural Dynamics, Manish Shrikhande, PHI Pub.

INDUSTRIAL HYDRAULICS & PNEUMATICS

Subject Code : 13ME4028 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand mechanism and calculations of various types of hydraulic pumps, motors, actuators.
- To understand workings of different types of direction, pressure, flow valves, and accumulators.
- To design and draw commonly used simple hydraulic circuits.
- To understand workings of various components in pneumatic and electro-pneumatic systems.
- To design and draw commonly used simple pneumatic circuits.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Explain mechanism and calculations of various types of hydraulic pumps, motors, actuators.
- Describe workings of different types of direction, pressure, flow valves, and accumulators.
- Design and draw commonly used simple hydraulic circuits.
- Describe workings of various components in pneumatic and electro-pneumatic systems.
- Design and draw commonly used simple pneumatic circuits.

UNIT-I

Pumps, Motors, Actuators: Introduction to fluid power, Hydraulic fluids, Hydraulic symbols.
Pumping Theory – Gear, vane, piston pumps – Pump performance
Hydraulic Motors – Gear, vane, piston motors – Motor performance
Hydraulic Actuators – Types, construction, specifications – 1^{st}, 2^{nd}, 3^{rd} class lever systems, cylinder cushions, Formulae and numericals on pumps, motors, actuators.

UNIT-II

Valves, Accumulators, Intensifiers: Direction, Pressure and Flow control valves with their various types, Formulae and numericals.
Accumulators – Function, types, size, applications and circuits, accessories.
Intensifiers – Applications, circuit.

UNIT-III

Design and Drawing of Hydraulic Circuits: Clamping circuits, Speed control in one and both directions, meter-in & meter-out circuits, standard manifold for dual speed, plastic injection molding machine circuit, hydraulic press circuit.

UNIT-IV

Pneumatic and Electro-Pneumatic Systems: Introduction to Pneumatic systems, Pneumatic symbols, Compressors – types, specifications, air control valves, pneumatic actuators.
Basic electrical components, Pilot operated solenoid valve, PE converter, PLC applications in fluid power.

UNIT-V

Design and Drawing of Pneumatic Systems: Basic pneumatic circuits, speed control circuits, application of time delay valves, position and pressure sensing, pressure sequence valve, pneumatic vacuum systems, pneumatic circuit analysis.

Text Books:

1. Fluid Power with Applications, Anthony Esposito, Pearson Publishers.
2. Introduction to Hydraulics and Pneumatics, S. Ilango, V. Soundararajan, PHI Publishers.

Reference Books:

1. Fluid Power Control, NPTEL Webcourse Lectures.
2. Fluid Power Transmission and Control, A. Alavudeen, K.H. Syed, N. Shanmugam, Charotar Pub.
3. Oil Hydraulic Systems, S.R. Majumdar, McGraw Hill Pub.
4. Pneumatic Systems: Principles and Maintenance, S.R. Majumdar, McGraw Hill Pub.

POWER PLANT ENGINEERING
(ELECTIVE – 2)

Subject Code : 13ME4029 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- Know various power plants & their applications.
- Explain construction & working of Steam power plants.
- Apply fundamental concepts of Gas turbine power Plants.
- Understand various types of Hydro-Electrical and Nuclear Power stations working.
- Calculate and measure capital cost, operational cost and general power distribution by using power plant economics.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Describe various conventional and non-conventional sources of energy. Various direct energy conversion methods.
- Explain construction & working of steam power plants along with its major subsystems, mountings and accessories including combustion of coal.
- Describe diesel and gas turbine power plants with auxiliary systems.
- Describe construction and working of hydro-electrical and nuclear power plants.
- Assess the power plant economy and cost analysis.

UNIT-I

Introduction to the Sources of Energy and Non-Conventional Sources: Utilization of Solar- Collectors-Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.
Direct Energy Conversion: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT-II

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, and Ash handling systems.
Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors

UNIT-III

Internal Combustion Engine Plant:
Diesel Power Plant: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.
Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined cycle Power Plants.

UNIT-IV

Hydro Electric Power Plant: Water power –Hydrographs – storage and Pondage – classification of dams and spill ways.
Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation. Types of Reactors, Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT-V

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises.

Text Books:

1. Engineering Thermodynamics, P. K. Nag, Tata McGraw-Hill Pub.
2. Thermal Engineering, M. L. Mathur, F. S. Mehta, Jain Brothers Pub.

Reference Books:

1. Thermal Engineering, P. L. Ballaney, Khanna Pub.
2. Thermodynamics, Spolding and Cole.
3. Thermal Engineering, R.K. Rajput, S.Chand & Co. Pub.
4. Introduction to Thermodynamics, J.B. Jones, G.A. Hawkins, John Wiley & Sons Pub.
5. Thermodynamics, Van Wylen, Sonntagg

ROBOTICS
(ELECTIVE – 2)

Subject Code : 13ME4030 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:
- This subject gives the knowledge about the fundamentals of the robotics technology and its wide area of applications in various fields.
- This gives the knowledge about the kinematic and dynamic aspects of the robot construction and designing aspects of the robots.

COURSE OUTCOMES:
On completion of this course, students should be able to
- Describe commonly used robot configurations, end effectors, drives along with robotics history and applications.
- Describe working principles of various sensors and actuators commonly used in a robot.
- Solve forward and inverse kinematic problems of common robot configurations. Solve dynamic problems using Lagrange-Euler and Newton-Euler formulations.
- Develop robot trajectory planning avoiding obstacles. Program robot motions for simple robot applications.
- Discuss robot cell design and manufacturing & non-manufacturing applications of robots.

UNIT-I
Fundamentals of Robotics: Introduction to Robotics & Overview – Historical development of Robotics – Robotics & Automation – Robotics & CAD/CAM – Classification of Robots based on Configuration & Control – Terminology - Components of Industrial Robots – DOF – End-effectors: Requirements, Challenges, Determination and Classification – Drive systems – Applications in present and future

UNIT-II: Robot Actuators & Sensing Systems
Introduction to Robotic Actuators – Classification of actuators – Difference between Electric, Pneumatic and Hydraulic actuators – Mechanical & other miscellaneous actuators
Sensing systems – Overview of sensing – Functions of sensing – Types – position sensors: potentiometer, resolvers, encoders, LVDT – Velocity sensors – Acceleration sensors – Force and Torque sensors – Optical, range & other miscellaneous sensors

UNIT-III: Kinematics & Dynamics of Manipulators
Kinematics and Dynamics: Introduction – Fundamental transformations – Properties – Homogeneous transformations – Applicable to both 2D & 3D in robotics – Forward & Inverse kinematic models – Denavit - Hartenburg (D-H representation for rotational joints – Applicable to forward kinematics & Problems – Applicable to Inverse kinematics & Problems – Differential transformations – Jacobian – Singularities – Lagrange- Euler (LE formulation – Newton-Euler (NE formulation

UNIT-IV: Trajectory Planning & Programming
Trajectory planning: Introduction – Terminology – Steps in trajectory planning – types of motions – Obstacle avoidance – Trajectory generation & types of trajectory
Programming: Introduction to robot programming – methods of programming – programming languages

UNIT-V: Robot Cell Design & Applications

Robot Cell Design: Introduction – Considerations and requirements – Selection of robot

Applications: Introduction – Manufacturing & Non-manufacturing applications – Selection of robot for a particular application (Case study

Text Books:

1. Industrial Robotics, M. P. Groover, Pearson Education Pub.
2. Robotics & Control, R. K. Mittal, I. J. Nagarath, Tata McGraw Hill Pub.

Reference Books:

1. Robotics, K. S. Fu, Lee, McGraw Hill Pub.
2. An Introduction to Robot Technology, P. Coiffet, M. Chaironze, Kogam Page Pub., London.
3. Robotic Engineering, Richard D. Klafter, Prentice Hall Pub.
4. Robot Analysis and Intelligence, Asada, Slow time, Wiley Inter-Science Pub.
5. Introduction to Robotics, John J Craig, Pearson Education Pub.
6. Robot Dynamics & Control, Mark W. Spong, M. Vidyasagar, John Wiley & Sons (ASIA Pub.

TRIBOLOGY
(ELECTIVE – 2)

Subject Code : 13ME4031 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:
- Know various parameters related to viscosity.
- Explain construction & working of bearings.
- Apply fundamental concepts of lubrication.
- Understand various types of lubrication including air lubrication.
- Understand various types bearing materials & their Properties.

COURSE OUTCOMES:
On completion of this course, students should be able to
- Discuss various parameters related to viscosity..
- Analyze of different types of bearings using hydrostatic lubrication theory.
- Analyze of different types of bearings using hydrodynamic lubrication theory.
- Analyze of different types of air lubricated bearings.
- Describe different types of bearing oil pads. Discuss the general requirements and types of bearing materials.

UNIT-I
Study of Viscosity Parameters: Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used.

UNIT-II
Hydrostatic Lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

UNIT-III
Hydrodynamic Theory of Lubrication: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti -friction bearing.

UNIT-IV
Air Lubricated Bearing: Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect.

UNIT-V
Types of Bearing Oil Pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings.
Bearing Materials: General requirements of bearing materials, types of bearing materials.

Text Books:
1. Fundamentals of Tribology, Basu, SenGupta, Ahuja, PHI Pub.
2. Tribology in Industry, Sushil Kumar Srivatsava, S. Chand &Co Pub.

Reference Books:
1. Tribology, B.C. Majumdar

MECHATRONICS
(ELECTIVE – 2)

Subject Code : 13ME4032 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- Understand mechanical, electrical and electronics engineering knowledge and skills to problems and challenges in the areas of mechatronics engineering.
- Generalize the complete design, building, interfacing and actuation of a mechatronic system for a set of specifications.
- Provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems
- Understanding of state of the art in power electronics converters and electromechanical drives: their operation, performance, and applications
- Developing of assembly level programs and providing the basics of the Microcontrollers
- Mode of operation and programming of a Programmable Logic Controller (PLC. Introductions to the purpose, functions, and operations of the PLC in industrial applications.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Describe various signal conditioning methods and control methods.
- Explain precision actuation systems including pneumatic, electro-pnuematic, hydraulic, electro-hydraulic systems.
- Describe electronic interface subsystems including CMOS, sensor and actuator interfacing.
- Describe electro-mechanical drives including relays, solenoids, motors, microcontrollers, D/A & A/D converters.
- Write ladder diagram programs to control PLCs. Design and tune PID controllers.

UNIT-I

Introduction: Definition – Trends - Control Methods: Standalone , PC Based , Applications: SPM, Robot, CNC, FMS, CIM.SIGNAL CONDITIONING : Introduction – Hardware - Digital I/O , Analog input – ADC , Amplifying signals using OP amps – Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT-II

Precision Mechanical Systems: Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts - Ball Screw and Nut

UNIT-III

Electronic Interface Subsystems: TTL, CMOS interfacing - Sensor interfacing - Actuator interfacing – solenoids , motors Isoation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

UNIT-IV

Electromechanical Drives: Relays and Solenoids - Stepper Motors - DC brushed motors - DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation Microcontrollers Overview, 8051 Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors – Applications

UNIT-V

Programmable Logic Controllers: Basic Structure - Programming : Ladder diagram Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls .PROGRAMMABLE **Motion Controllers**: Introduction - System Transfer Function - Laplace transform and its application in analysing differential equation of a control system s - Control System Performance & tuning - Digital Controllers - P , PI , PID Control

Text Books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, W Bolton, Pearson Education Pub.
2. Mechatronics, M. D. Singh, J. G. Joshi, PHI Pub.

Reference Books:

1. Mechatronics Source Book, Newton C Braga, Thomson Pub. Chennai.
2. Mechatronics, N. Shanmugam, Anuradha Agencies Pub.
3. Mechatronics System Design, Devdas Shetty, Richard, Thomson Pub.

AIR QUALITY MANAGEMENT
(OPEN ELECTIVE)

Subject Code : 13OE4001 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:
- To identity different pollutants which are causing air pollution.
- To understand the thermodynamics and kinetics of air pollution.
- To apply the professional knowledge of air pollution to design pollution control systems.
- To aim for employment in pollution control organizations.
- To apply the professional, ethics, attitude, team work skills, multi disciplinary approach to contribute the needs of society in the field of environmental protection.

COURSE OUTCOMES:
On completion of this course, students should be able to
- Solve air pollution problems of industries.
- Create awareness among the public on effects of air pollution at local and global level.
- Anage the ambient air quality by maintaining emission standards.
- Get successful employment in organizations working for the protection of environmental.
- Design air pollution control equipments for industries and other polluting sources.

UNIT-I
Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Measurement of Pollution Classifications – Natural and Artificial –Primary and Secondary, point and Non- Point, Line and Areal Sources of air pollution- stationary and mobile sources.

UNIT- II
Effects of Air pollutants on man, material and vegetation: Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, and Ozone Holes-Effects of art treasures.

UNIT-III
Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control. Equipment's – Settling Chambers, Centrifugal separators, Reverse Flow Cyclones, Fabric filters – Bag House, Dry and Wet scrubbers, Electrostatic precipitators.

UNIT- IV
General Methods of Control of NO_2 and SO_2 emissions – In-plant Control Measures, process changes, dry and wet methods of removal and recycling.

UNIT- V
Ambient Air Quality Management – Monitoring of SPM, SO; NO and CO Stack Monitoring for the Flue gases –Micro meterological monitoring Emission Standards.

Text Books:
1. Air Pollution, M. N. Rao, H. V. N. Rao, Tata Mc.Graw Hill Pub.
2. Air Pollution and Control, K.V.S.G. Murali Krishna

Reference Books:
1. An Introduction to Air Pollution, R.K. Trivedy, P.K. Goel, B.S. Pub.
2. Air Pollution, Wark, Warner, Harper & Row Pub., New York.

CYBER LAWS
(OPEN ELECTIVE)

Subject Code : 13OE4002 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:
- To identify the emerging Cyber law trends
- To create more awareness about the newly emerging kinds of cybercrimes
- To identify the areas in cyber crimes where Cyber law needs to be further evolved
- To identify the impact of Cyber Law on Real World
- To identify the importance of cyber law and its professionals.

COURSE OUTCOMES:
On completion of this course, students should be able to
- Have comprehensive information about security policies, establishing necessary organizational processes /functions for information security and will be able to arrange necessary resources.
- Understand, analyze and work on activities of fraud prevention, monitoring, investigation, reporting.
- Differentiate among the models, architectures, challenges and global legal constraints of secure electronic commerce technologies used to ensure transmission, processing and storage of sensitive information.
- Have knowledge of cyber law and ethics.
- Evaluate the interaction and relative impact of human factors, processes and technology in cyber law infrastructures.

UNIT- I
The IT Act, 2000: A Critique: Crimes in this Millennium, Section 80 of the IT Act, 2000 – A Weapon or a Farce?, Forgetting the Line between Cognizable and Non- Cognizable Officers, Arrest for "About to Commit" an Offence Under the IT Act, A Tribute to Darco, Arrest, But No Punishment.

UNIT- II
Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000: Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber fraud and Cyber Cheating, Virus on Internet Deformation, Harassment and E-mail Abuse

UNIT- III
DE-Commerce Taxation - Real Problems in the Virtual World: A Tug of War on the Concept of Permanent Establishment, Finding the PE in Cross Border E-Commerce, Source versus residence and classification between Business Income and Royalty, The impact of the internet on Customs duties, Taxation policies in India.

UNIT- IV
Digital Signatures, Certifying Authorities and E-Governance: Digital Signatures, Digital Signature Certificate, Certifying Authorities and Liability in the Event of Digital Signature compromise, E-Governance in the India. A Warming to Babudom

UNIT-V
Protection of Cyber Consumers in India: Are Cyber Consumers Covered under the Consumer Protection, Goods and Services, Consumer Complaint, Defect in Goods and Deficiency in Services, Restrictive and Unfair Trade Practices

Text Books:

1. Cyber Law Simplified, Vivek Sood, Tata McGraw-Hill Pub.
2. Cyber Law. Texts & Cases, South-Western's Special Topics Collections

Reference Books:

1. Law Relating to Computers Internet & E-Commerce, Nandan Kamath , 2nd Edition, Universal Law Pub.
2. Cyber Law in India, Farooq Ahmad, Pioneer Books.
3. Information Technology Law and Practice, Vakul Sharma, Universal Law Pub.
4. The Indian Cyber Law, Suresh T Vishwanathan, Bharat Law House, New Delhi.
5. Handbook of Cyber & E-commerce Laws, P. M. Bakshi, R. K. Suri, Bharat Law house, New Delhi.
6. Guide to Cyber Laws, Rodney D. Ryder, Wadhwa and Company Nagpur.
7. The Information Technology Act,2000 – Bare Act – Professional Book Pub., New Delhi.

ENTREPRENEURIAL DEVELOPMENT
(OPEN ELECTIVE)

Subject Code : 13OE4003 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- The objective of this course is to expose the students to the subject of entrepreneurial development, so as to prepare them to establish a new enterprise and effectively manage the enterprise.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Understand the concept of Entrepreneurship and demonstrate the ability to provide a self analysis on Entrepreneurship qualities in the context of an Entrepreneurial career.
- Understanding Entrepreneurship Development programmes in INDIA and contents for training for Entrepreneurial competencies.
- Create appropriate business model and develop well presented business plan that is feasible for the student.
- Understanding how to manage effectively the selected business.

UNIT-I

Entrepreneur and Entrepreneurship: Nature and Scope of Business. Concept of Entrepreneur, characteristics of an Entrepreneur, difference between an Entrepreneur and manager, functions of an Entrepreneur, types of Entrepreneurs, Intrapreneur. Concept of Entrepreneurship, women entrepreneurship and rural entrepreneurship. Role of Entrepreneurship in Economic development. Ethics and social responsibility of an entrepreneur. Future of Entrepreneurship in India.

UNIT-II

Entrepreneurship Development in India: Nature and development of Entrepreneurship in India - emergence of entrepreneurial class in India, Environmental factors effecting entrepreneurship, local mobility of Entrepreneurs, development of women Entrepreneurship, problems and remedies of women Entrepreneurship. Entrepreneurship Development programme (EDP - need and objectives of EDPs, Designing Appropriate training programme to include course contents, phases and evaluation of EDPs for existing and new entrepreneurs. Institutions supporting for EDP - NIESBUD, EDII, NAYE, TCOs, MSMEDI, DICs, commercial Banks, Universities and Engineering colleges..

UNIT-III

Creating and Starting the Venture: Types of start ups. Steps to start an MSME. Meaning of a project. Project Identification- Sources of new Ideas, methods of generating ideas, creative problem solving, and opportunity recognition. Project selection - meaning of project report (Business Plan, Formulation of a project report, project appraisal by economic analysis, financial Analysis, market analysis, technical Feasibility, managerial competence. Project implementation. preparation of sample project report of any one product and service.

UNIT-IV

Government and Institutional Support to Entrepreneurs: MSME Development Act-2006. Technology Incubation Centre, Business Incubation Centre, National Skill Development Corporation, Institutional finance – sources of short term and long term capital, Venture capital. Role of IDBI, SIDBI, APIIC, NSIC, APSFC, APITCO, EXIM Bank and commercial Banks, APSFC, ect. AP Industrial policy (2015-20- incentives and subsides, industrial estates, AP Skill Development Corporation.

UNIT-V

Managing the Venture: Types of Ownership. Concepts of working capital management, Marketing management, Human Resource management and TQM. Problems and prospects of MSME in India. Profile of entrepreneurs.

Text Books:

1. Fundamentals of Entrepreneurship, H. Nandan, PHI Learning Pub., New Delhi.
2. Entrepreneurial Development, S. Chand Pub., New Delhi
3. Entrepreneurship and Small Business Management, Dr. C.B. Gupta, Dr. S.S. Khanka, Sultan Chand & Sons Pub.
4. Entrepreneurship, Narayana Reddy, Cengage Learning Pub., New Delhi.
5. Entrepreneurship, Rajeev Roy, Oxford University Press, New Delhi.
6. The Dynamics of Entrepreneurial Development and Management, Vasat Desai, Himalaya Publishing House.

References Books:

1. Entrepreneurship, Robert D Hisrich, Michel P Peters, Dean A Sheperd, Tata McGraw Hill Pub.
2. Entrepreneurship, Hisrich, Tata McGraw Hill Pub., New Delhi.
3. Projects, Prasanna Chandra, Tata McGraw Hill Pub., New Delhi.
4. Project Management, K. Nagarajan, New Age International Pub., New Delhi.

INDUSTRIAL SAFETY AND ENIVRONMENT
(OPEN ELECTIVE)

Subject Code : 13OE4004 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:
- To familiarize the student with fundamentals principles of safety management.
- To impart knowledge on different type of industrial hazards.
- To enable the student to know the various industrial safety acts.
- To understand the environmental safety.

COURSE OUTCOMES:
On completion of this course, students should be able to
- Understand the principles of safety management including safety audit, safety performance monitoring and safety education.
- Describe the various environmental safety measures for reduction of air, water, hazardous material pollution.
- Discuss occupational health and industrial hygiene including physical, chemical, biological, ergonomical hazards.
- Understand various industrial safety, health and environmental acts.
- Understand various international acts and standards relating to safety and environment.

UNIT-I
Principles of Safety Management: Concepts and techniques, safety audit- introduction, accident investigation and reporting, safety performance monitoring, safety education and training

UNIT-II
Environmental Safety: Air pollution, water pollution, hazardous waste management, environmental measurement and control, pollution control in process industries

UNIT-III
Occupational health and industrial hygiene; physical hazards, chemical hazards, biological and ergonomical hazards, occupational physiology

UNIT–IV
Industrial safety, health and environment acts; factories act– 1948, environment act– 1986, manufacture, storage and import of hazardous chemical rules 1989

UNIT-V
International acts and standards, other acts and rules (Indian boiler act 1923, static and mobile pressure vessel rules (smpv, motor vehicle rules

Text books:
1. Safety Management in Industry, N.V. Krishnan, Jaico Publishing House, Bombay, 1997.
2. Environmental Pollution Engineering, C.S. Rao, Wiley Eastern Limited, New Delhi, 1992

Reference Books:
1. Pollution Control in Process Industries, S. P. Mahajan, Tata McGraw Hill Pub., New Delhi, 1993.
2. Handbook of Occupational Safety and Health, National Safety Council, Chicago, 1982
3. The Factories Act 1948, Madras Book Agency, Chennai, 2000
4. The Environment Act (Protection 1986, Commercial Law Publishers (India Pvt. Ltd. New Delhi.
5. Water (Prevention and Control of Pollution Act 1974, Commercial Law Publishers (India Pvt. Ltd., New Delhi.

MICRO ELECTRO MECHANICAL SYSTEMS (MEMS (OPEN ELECTIVE)

Subject Code : 13OE4005 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand various MEMS fabrications processes including additive, subtractive, patterning, material modification processes and mechanical steps.
- To understand workings of MEMS mechanical and thermal sensors and actuators
- To understand mechanisms of MEMS magnetic sensors and actuators and Micro-fluidic devices
- To understand mechanisms of MEMS optical and RF devices.
- To be exposed to MEMS simulation softwares, Multiscale simulations, CNT and NEMS.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Explain various micro-machining processes including material addition (thin film deposition, photo lithography, modification (doping, deletion (etching, bulk & surface micro-machining, LIGA processes.
- Describe construction and working of important MEMS mechanical and thermal devices.
- Comprehend construction and operation of important MEMS magnetic sensors and actuators and micro-fluidic devices.
- Explain construction and mechanism of important MEMS optical and radio frequency components.
- Explain MEMS simulation softwares, Multiscale simulations, CNT and NEMS.

UNIT-I

Micro-Machining Processes: Additive Processes – Spin coating, Evaporation, Sputtering, PVD, CVD, PECVD, Thermal oxidation.
Subtractive Processes – Plasma etching, Reactive ion etching, DRIE etching, Wet chemical etching
Pattering Processes – Photolithography, X-ray Lithography, LIGA
Material Modification Processes – Ion implantation doping, Diffusion doping, Thermal annealing
Mechanical Steps – Polishing, Wafer bonding, Wafer dicing, Wire bonding, Chip packaging

UNIT-II

Mechanical Sensors and Actuators: Principles of mechanical sensing and actuation – beam, plate, capacitive, piezo-electric. Strain measurement, Pressure measurement, Flow measurement, Gyroscopes. Specialized Actuators – Shear-mode piezo, Gripping piezo, Inchworm technology.

Thermal Sensors and Actuators: Thermal transduction phenomena - Thermo-electric, Thermo-resistive, Pryo-electric effects. Micro-machined thermo-couple probe, Peltier effect heat pump. Thermal flow sensors, Micro-hot plate gas sensors, Thermo-vessels. Pyro-electricity, Shape memory alloys, Electro-thermal actuator, Thermally activated MEMS relay, Micro-spring thermal actuator, Data storage cantilever.

UNIT-III

Magnetic Sensors and Actuators: Magnetic properties of materials, Presence and detection of large objects, Magneto-restrictive sensor, Hall effect sensor, Magneto-diode, Magneto-transistor, MEMS magnetic sensor, Pressure sensor utilizing MOKE, MagMEMS actuators, Optical switches, Bi-directional micro-actuator, Feedback circuit integrated magnetic actuator, Large force reluctance actuator, Magnetic probe based storage device.

Micro-Fluidics: Introduction, Properties of fluids, Micro-fluidic design considerations. Fluid actuation methods – Di-electro-phoresis, Electro-wetting, Electro-thermal, Thermo-capillary, Electro-osmosis, Opto-electro-wetting. Tuning of fiber optic cables using micro-fluidics, Micro-fluidic channel, Dispenser, Needle, Molecular gate, Micro-pump,

UNIT-IV

Optical Sensors and Actuators: Properties of light, Light modulators, Beam splitter, Micro-lens, Micro-mirror, Optical switch. Digital Micro Device (DMD using Digital Light Processing (DLP technology. Diffraction grating, Grating light valve, Waveguide and tuning.

RF MEMS: Introduction to RF Communication and RF MEMS, MEMS inductors, Varactors, Tuner/filter, Resonator, MEMS switches, Phase shifter.

UNIT-V

MEMS Simulations: Atomistic to Continuum theory, Multiscale concept, Multiscale methods.
Softwares - Ansoft Designer, HFSS, DS/MEMS and CA/MEMS, FEMPRO, ANSYS Multiphysics, SUGAR.

NEMS

Introduction to NEMS , properties, applications, fabrication methods, future development.

Text Books:

1. MEMS, Nitaigour Premchand Mahalik, Tata McGraw Hill Pub.

Reference Books:

1. Foundations of MEMS, Chang Liu, Pearson Pub.
2. MEMS & Microsystems – Design and Manufacture, Tai-Ran Hsu, McGraw Hill Pub.

IV Year B. Tech., I Semester

OPTIMIZATION TECHNIQUES
(OPEN ELECTIVE)

Subject Code : 13OE4006 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:
- To be able to formulate linear or nonlinear optimization problems as a solution for industrial problems.
- To be able to solve various kinds linear and nonlinear, single and multiple variable, unconstrained and constrained optimization problems using standard optimization algorithms.

COURSE OUTCOMES:
On completion of this course, students should be able to
- Solve single variable and multi variable optimization problems using classical optimization techniques.
- Solve linear programming problem using simplex method along with its Big-M and 2-Phase variations. Solve primal as well as dual simplex problems.
- Solve assignment problems using Hungarian's algorithm, degeneracy and also traveling salesman problem.
- Solve 1D unconstrained non-linear optimization problems using various methods.
- Calculate optimum solution of unconstrained and constrained geometric programming problems.

UNIT-I
Introduction to Classical Optimization Techniques:
Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions

UNIT-II
Linear programming: Two-phase simplex method, Big-M method, duality, interpretation, applications

UNIT-III
Assignment problem: Hungarian's algorithm, Degeneracy, applications, unbalanced problems, traveling salesman problem.

UNIT-IV
One dimensional Optimization methods:
Elimination Methods: - Fibonacci, Golden Section.
Interpolation Methods: - Quadratic, Cubic.
Direct Root Methods: - Newton, Quasi-Newton, Secant Methods. Gradient of a function, steepest descent method.

UNIT-V
Geometric Programming: Polynomials – arithmetic - geometric inequality – unconstrained G.P-constrained G.P

Text Books:
1. Engineering Optimization, Theory and Applications, S.S. Rao, New Age International Pub.
2. Optimization for Engineering Design, Kalyanmoy Deb, PHI Pub.

Reference Books:
1. Optimization Techniques, Theory and Practice, M. C. Joshi, K. M. Moudgalya, Narosa Pub.
2. Engineering Optimization, A Ravindran, K M Ragsdell, G V Reklaitis

RENEWABLE ENERGY
(OPEN ELECTIVE)

Subject Code : 13OE4007 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To Outline the concept regarding the physics of the sun
- To Outline the concept regarding the collection of solar energy and storage of solar energy
- To Outline the concept regarding different types of wind mills and different types of biogas digesters
- To Outline the concept regarding geothermal energy conversion
- To Outline the concept regarding direct energy conversion

COURSE OUTCOMES:

On completion of this course, students should be able to

- Define different kind of solar radiation
- Utilize different methods of collection of solar energy and storage of solar energy
- Classify different types of wind mills and biogas digesters
- Classify different types of geothermal energy sources and utilize different types of extracting techniques
- Distinguish different kinds of direct energy conversion techniques

UNIT-I

Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data

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UNIT-II

Solar Energy Collection, Storage and Applications: Flat plate and concentrating collectors, classification of concentrating collectors, orientation , advanced collectors. Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-III

Wind and Biomass Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria. Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

UNIT-IV

Geothermal and Ocean Energy: Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermoelectric generators, seebeck, peltier and joul Thomson effects, MHD generators, principles, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion. Fuel cells, principles, faraday's law's, selection of fuels and operating conditions.

Text Books:

1. Non-Conventional Energy Sources , G.D. Rai
2. Renewable Energy Technologies, Ramesh, Kumar, Narosa Pub.

Reference Books:

1. Renewable Energy Resources, Tiwari, Ghosal, Narosa Pub.
2. Non-Conventional Energy, Ashok V Desai, Wiley Eastern Pub.
3. Non-Conventional Energy Systems, K Mittal, Wheeler
4. Solar Energy, Sukhame

ADVANCED MATERIALS
(OPEN ELECTIVE)

Subject Code : 13OE4008 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:
- To know different types of composite materials.
- To learn different manufacturing methods of the composite materials.
- Distinguish between the properties and uses of different reinforcement fibres.
- Explain the principles, types and applications of different functionally graded materials and shape memory alloys.
- To know about the nanomaterials and nanotechnology.

COURSE OUTCOMES:
On completion of this course, students should be able to
- Classify composite materials and describe various manufacturing methods.
- Distinguish between properties and uses of different reinforcement fibers. Discuss manufacturing of ceramic matrix composites.
- Explain the principles, types and applications of smart materials including SMA, piezo-electric, electro-rheological and magneto-rheological materials.
- Describe biomaterials with respect to biocompatibility, cell-material interaction and body response to foreign materials.
- Outline the nanomaterials types, methods of creating nanostructures, their physical and mechanical properties and applications.

UNIT-I
Introduction to Composite Materials and Manufacturing Processes: Introduction, Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon-Carbon Composites, Fiber- Reinforced Composites.
Manufacturing Methods: Autoclave, tape production, moulding methods, filament winding, manual layup, pultrusion.

UNIT-II
Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres.
Metal Matrix and Ceramic Matrix Composites: Manufacturing of ceramic matrix & metal matrix composites and their applications, stress strain relations for MMC and CMC.

UNIT-III
Smart Materials: Shape memory alloys, Piezoelectric materials, Electro-rheological fluid, Magneto-rheological fluid.

UNIT-IV
Bio-materials: Property requirement, Concept of biocompatibility, Cell-material interaction and body response to foreign materials.

UNIT-V
Nano-materials & Technology: Definition, Types of nanomaterials including carbon nanotubes and nanocomposits, Methods for creating nano structures, Processes for producing ultrafine powders - physical synthesis and chemical synthesis, Physical and mechanical properties and their applications

Text Books:

1. Nano material, A.K. Bandyopadyay, New Age Pub.
2. Material Science and Technology, Cahan
3. Engineering Mechanics of Composite Materials, Isaac, M Daniel, Oxford University Press.
4. The Science and Engineering of Materials, D. R. Askeland, P. P. Phule, Thomson Pub.
5. Advances in Material Science, R. K. Dogra, A. K. Sharma
6. Engineering Materials and Applications, R. A. Flinn, P. K. Trojan
7. An Introduction to Biomaterials, Jeffrey O. Hollinger, CRC Press.

Reference Books:

1. Mechanics of Composite Materials, R. M. Jones, McGraw Hill Pub., New York, 1975.
2. Analysis and Performance of Fibre Composites, B. D. Agarwal, L. J. Broutman, Wiley-Interscience Pub., New York, 1980

TOTAL QUALITY MANAGEMENT
(OPEN ELECTIVE)

Subject Code : 13OE4009 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:
- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

COURSE OUTCOMES:
On completion of this course, students should be able to
- Develop an understanding on quality management philosophies and frameworks.
- Understand the fundamental principles of total quality management.
- Choose approximate statistical techniques for improving processes. Evaluate reliability for complex systems.
- Develop in-depth knowledge on various tools and techniques of quality management.
- Understand ISO and QS certification process and its need for the industries.

UNIT-I
Introduction: Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT-II
TQM Principles: Customer satisfaction - Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement - Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement - Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures - Basic Concepts, Strategy, Performance Measure.

UNIT-III
Statistical Process Control and Process Capability: Meaning and significance of statistical process control (SPC – construction of control charts for variables and attributes.
Process capability – meaning, significance and measurement – Six sigma concepts of process capability.
Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve.Total productive maintenance (TMP–relevance to TQM, Terotechnology. Business process re-engineering (BPR – principles, applications, reengineering process, benefits and limitations.

UNIT-IV
Tools and Techniques for Quality Management: Quality functions deployment (QFD – Benefits, Voice of customer, information organization, House of quality (HOQ, building a HOQ, QFD process. Failure mode effect analysis (FMEA – requirements of reliability, failure rate, FMEA stages, design, process and documentation. Seven old (statistical tools. Seven new management tools. Bench marking and POKA YOKE.

UNIT-V

Quality Systems: Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System - Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 - Concept, Requirements and Benefits.

Text Books:

1. Total Quality Management, Dale H.Besterfield et al, 3rd ed, Pearson Education Pub.
2. Total Quality Management – Text and Cases, K. Shridhara Bhat, Himalaya Pub.

Reference Books:

1. James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition, South-Western (Thomson Learning, 2002 (ISBN 0-324-06680-5.
2. Total Quality Management, A.V. Feigenbaum, McGraw Hill Pub.
3. Total Quality Management, J. S. Oakland, Butterworth Heinemann Pub.,
4. Quality Management - Concepts and Tasks, V. Narayana, N.S. Sreenivasan, New Age International Pub.
5. Total Quality Management for Engineers, Zeiri, Wood Head Pub.

PNEUMATICS AND HYDRAULICS LAB

Subject Code : 13ME4112 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

- To study hydraulic meter-in, meter-out, bleed-off, transverse and feed circuits.
- To study hydraulic speed, pressure and flow control along with hydraulic valves and actuators.
- To study pneumatic single and double acting cylinders, 5/2, 3/2 way valves.
- To study pneumatic AND, OR logical circuits and pneumatic control system.
- To model direct and indirect control of single and double acting cylinder.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Design hydraulic actuator speed control circuit.
- Design hydraulic single and double acting cylinder circuits.
- Design hydraulic bleed-off, sequence valve, transverse and feed circuits.
- Design pneumatic single and double acting cylinder circuits.
- Work with pneumatic motor, Non return valve, shuttle valve, 5/2, 3/2 way valves.

LIST OF EXPERIMENTS:

Experiments using Basic Hydraulic Trainer Kit

1. Study of Hydraulic Meter-in & Meter-out & Bleed-off Circuits
2. Study of Hydraulic Transverse & Feed Circuits
3. Study of Hydraulic Speed Control, Pressure Control and Flow Control
4. Study of Hydraulic Valves, Hydraulic Actuators, Hydraulic Power Pack

Experiments using Basic Pneumatic Trainer Kit

5. Study of Pneumatic Cylinders: Single Acting, Double Acting
6. Study of Different Pneumatic circuits such as AND-OR Logical circuits.
7. Study of Pneumatic Control System
8. Study of construction & operation of pneumatic equipments such as 5/2 way valve, 3/2 way valve, pneumatic motor.

Experiments using Automation Studio Software

1. Basic circuit for direct control of a single acting cylinder.
2. Basic circuit for indirect control of a single acting cylinder.
3. Basic circuit for direct control of a double acting cylinder.
4. Basic circuit for indirect control of a single acting cylinder.

HEAT TRANSFER LAB

Subject Code : 13ME4113 **Internal Marks: 25**
Credits: 2 **External Marks: 50**

COURSE OBJECTIVES:

The course content enables students to:

- Impart experimental experience in Heat Transfer Lab those support Mechanical Engineering.
- Provide students with an opportunity of direct experience of doing Heat Transfer Lab calculation so that they can understand the base of the principles and able to make a critical assessment of industrial environment.
- Teach the students fundamentals in element of Heat Transfer & its applications. So as to identify, formulate and solve the problems of Heat Transfer device designs.
- Develop an idea about how to measure heat transfer coefficients/constant like h, emissivity, Stefan Boltzmann constants for devices like metal rod, lagged pipe, etc.,
- Encourage the students to understand importance energy conversation and make them to experience with practical applications in Heat Transfer Lab.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Evaluate heat transfer through lagged pipe, Insulating powder.
- Determine the Thermal conductivity of a given metal Rod and overall heat transfer coefficient for a composite slab.
- To Measure the Heat transfer coefficient for Pin Fin, Forced convection, Natural Convection, and Drop and Film wise condensation.
- Determine heat transfer in parallel-flow and counter-flow heat exchanger.
- Determine radiation heat transfer using Stefan-Boltzman and emissivity apparatus.

List of Experiments:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan- Boltzman Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.

CAE LAB

Subject Code : 13ME4114 **Internal Marks: 25**
Credits: 3 **External Marks: 50**

COURSE OBJECTIVES:

- To perform finite element analysis on various components and structural elements and find the deflections and stresses for different loading conditions.
- To calculate the natural frequencies and forced response for 2D and 3D structures using FEA.
- To simulate the tool path of cutting tool on the work piece in computer aided manufacturing.
- To generate NC program on verification of tool path for simple components in turning or milling.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Determine deflections and stresses in 1D & 2D bars, trusses and beams; and 2D plane stress, plane strain, axisymmetric models by conducting static FE analysis.
- Determine deflections and stresses in 3D bodies, 3D shell components by conducting static FE analysis.
- Estimate natural frequencies and mode shapes, harmonic response of 2D beams using FEA.
- Conduct steady state thermal analysis on 2D and 3D models.
- Develop NC program to create simple components on NC lathe or mill in a CAM package. Simulate the tool path and check for errors in virtual manufacturing environment.

1. **Introduction to finite element analysis packages ANSYS or NASTRAN**
    a. Static Analysis of bars, beams and trusses.
    b. Static Analysis of 2D and 3D models
    c. Modal Analysis of 2D and 3D models
    d. Harmonic Analysis of 2D and 3D models
    e. Thermal analysis of 2D and 3D models.

2. **Tool Path Simulation and NC Code Generation**
    NC Code generation using CAD / CAM software - Post processing for standard CNC Controls for any of FANUC, Siemens, Hiedenhain etc.

IV Year B. Tech., I Semester

EMPLOYABILITY SKILLS

Subject Code : 13HS4203 **Internal Marks: 75**
Credits: 2

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PRODUCTION PLANNING AND CONTROL

Subject Code : 13ME4033 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand production systems and their characteristics.
- To evaluate types of forecasting techniques and to compare qualitative and quantitative methods.
- To understand material requirement planning procedures.
- To apply aggregate planning strategies.
- To describe routing procedure and scheduling policies & techniques.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Describe the objectives and functions of PPC and the types of production. Evaluate different types of forecasting techniques.
- Apply aggregate planning strategies. Discuss line balancing and planning methods.
- Evaluate MRP and JIT systems against traditional inventory control systems.
- Apply scheduling techniques to production systems.
- Draw route sheets. Explain activities of dispatching and expediting.

UNIT-I

Introduction to PPC and Forecasting: Definition, Objectives, Functions of Production Planning and Control, Types of Production systems and their Characteristics, Comparison between Production Planning and Production Control, Organization for PPC.

Forecasting: Introduction, Long-term and Short-term Forecasting, Classification of Forecasting Methods, Judgmental Techniques, Time Series analysis, Moving Average Forecasting, Exponential Smoothing Method, Casual Forecasting Method,

UNIT-II

Planning: Capacity Planning, Factors Influencing Effective Capacity, Aggregate Planning, Strategies and Costs.

Assembly Line Balancing, Master Production Schedule, Functions of MPS, Preparation of MPS.

UNIT-III

Planning for Materials Requirement: Inventory management, Functions of inventories, Relevant inventory costs, EOQ models, Quantity Discount models, Inventory control systems : P-System and Q-System.

MRP, MRP II, Concept of JIT, Basic Elements of JIT, Benefits of JIT, KANBAN System and Implementation of JIT.

UNIT-IV

Scheduling: Flow-shop scheduling, Characteristics of flow shop scheduling, **n** jobs and two machines scheduling, **n** jobs and three machines scheduling, Line of Balance (LOB) Technique.

Job shop scheduling, Characteristics of job shop scheduling, Two jobs and M machines scheduling (Graphical Method), Sequencing by priority rules: Shortest processing time(SPT) ,First come first serve(FCFS) ,Most work remaining(MWKR), Most operations remaining,(MOPNR), Least work remaining(LWKR), Random sequencing

UNIT-V:

Routing, Dispatching and Expediting:

Routing: Definition, Routing procedure, Factors affecting routing procedure, Route sheet, Bill of material.

Dispatching: Activities of dispatcher, Dispatching procedure.

Expediting: Definition, Reasons for existence of function, Types of expediting, Applications of computer in production planning and control.

Text Books:

1. Industrial Engineering and Production Management, Martand Telsang, S. Chand Publications.
2. Operations Management – Design, Planning and Control for Manufacturing and Services, James. B. Dilworth, McGraw Hill International Publications.

Reference Books:

1. Modern Production / Operations Management, Elwood S. Buffa, Rakesh K. Sarin, John Wiley Publications.
2. Production Planning Control and Industrial Management, K. C. Jain, L. N. Aggarwal, Khanna Publications.
3. Theory and Problems in Production & Operations Management, S. N. Chary, Tata McGraw Hill Publications.

INDUSTRIAL AUTOMATION
(ELECTIVE – 3)

Subject Code : 13ME4034 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To explain the general functions, types and strategies of automation.
- To classify the material transport systems in production and perform analysis of the transfer lines used in production.
- To apply line balancing techniques to improve the line balance and line efficiency.
- To distinguish various material handling and storage systems and explain their functions.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Explain the types and strategies of automation.
- Determine the problems and assess the performance of automated flow lines in manufacturing domain.
- Identify the bottlenecks occurred in production systems and will be able to balance the production line.
- Distinguish between different material handling systems and employ suitable material handling system. Explain various automated storage and retrieval systems.
- Discuss computer aided inspection methods including CMM and machine vision. Explain BPRE, CE and rapid prototyping methodologies.

UNIT-I

Fundamentals of Automation: Introduction to automation – Definition – Types of automation & Layouts – Reasons of automation – Automation strategies – Hydraulic & Pneumatic components used in automation – Automation in Machine tools: Feeding devices, Tool changing devices Control

UNIT-II

Automated Production Lines & Analysis: Introduction – Classification of transfer lines – Work part transfer mechanisms – Work part transfer systems – Mechanical buffer storage – Control functions – Fabrication & design considerations – Analysis of transfer lines: with and without storage buffer – Terminology used in transfer line analysis – Problems – Partial automation - Implementation

UNIT-III

Manual & Automated Assembly Systems: Assembly systems: Introduction – Types – Manual assembly systems – Automated assembly systems – Assembly processes – Line balancing – Methods of line balancing (Algorithms – Line balancing improving techniques – Flexible assembly lines

UNIT-IV

Automated Material Handling & Storage Systems

Material Handling Systems: Introduction – Principles of material handling – Types of MHS – Design & Analysis of MHS – Conveyor Systems – Types – Applications of MHS – Automated Guided Vehicle systems

Storage Systems: Introduction to storage systems – Applications of storage systems – Types of Storage systems – AS/RS – Types & Applications – Identification & Tracking Systems – Bar Codes - Types

UNIT-V

Inspection Methods: Introduction – Classification – Machine Vision - Coordinate Measuring Machine

BPRE, CE & Rapid Prototyping: Introduction to Business Process Re-engineering (BPRE) – Concurrent Engineering – Rapid Prototyping – Types of RP – Applications & Benefits

Text Books:

1. Automation, Production Systems & Computer integrated Manufacturing Systems, M P Groover, PHI Publications.
2. CAD/CAM/CIM, Radhakrishnan, New Age International(P) Ltd. Publications

Reference Books:

1. Automation,W. Buekinsham, PHI Publications
2. Principles of CAD/CAM, P N Rao, Tata McGraw Hill Publications

NON-CONVENTIONAL SOURCES OF ENERGY
(ELECTIVE – 3)

Subject Code : 13ME4035 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To enable the students in understanding various types of global energy resources available for power generation.
- To enable the students understand the importance of energy efficiency and conservation in the context of future energy supply
- To expose students to future energy systems and energy use scenarios with a focus on promoting the use of non-conventional energy resources and technologies.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Explain structure and Coordinate system of Sun. Solve problems based on solar radiation on titled surfaces. Understand orientation and thermal analysis of solar energy collectors.
- Explain the Sensible Heat, Latent Heat, and Stratified storage systems. Understand the mechanisms involved in harnessing solar energy in various applications.
- Classify types, components and performance characteristics of Windmills. Understand combustion characteristics of biogas.
- Generalize various types of wells to get geothermal energy. Understand the working principles involved in harnessing tidal energy and wind energy. Discuss mini-hydro-power plants.
- Describe direct energy conversion systems by using MHD generator, thermo-ionic converters and PV fuel cells.

UNIT-I

Solar Radiation: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, numerical problems.

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. Design and analysis of solar PV panels for 100 KW power generation.

UNIT-III

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, types of winds, wind data measurement.

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.

UNIT-VI

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, See-beck, Peltier and Joul Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions, photo voltaic energy conversion – types of PV cells, I-V characteristics.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage, S.P. Sukhatme, J.K.Nayak, TMH Pub.
2. Non-Conventional Energy Sources, G.D. Rai
3. Non-Conventional Energy Resources, B.H. Khan, Tata McGraw Hill Pub., New Delhi.

Reference Books:

1. Solar Power Engineering, B.S Magal, Frank Kreith, J.F Kreith
2. Principles of Solar Energy, Frank Krieth, John F Kreider
3. Non-Conventional Energy, Ashok V Desai, Wiley Eastern Pub.
4. Renewable Energy Technologies, Ramesh, Kumar, Narosa Pub.

FUZZY LOGIC SYSTEMS AND NEURAL NETWORKS
(ELECTIVE – 3)

Subject Code : 13ME4036 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

By the end of this course, the student should be able to

- Explain the concepts of neural networks, fuzzy logic,
- Solve problems that are appropriately solved by neural networks and fuzzy logic.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Knowledge of neural network architecture and biological neuron system.
- Describe the learning and retrieval procedures of various neural networks.
- Have an understanding of back propagation networks techniques and back propagation algorithm.
- Knowledge of fuzzy set theory and comprehend the concept of fuzziness involved in various systems
- Analyze the application of fuzzy logic control to real time systems

UNIT-I

Fundamentals of Neural Networks: What is a neural network? Human Brain, Model of an Artificial Neuron, Neural network Architectures, Characteristics of neural networks, early neural networks architecture Application Domains.

UNIT-II

Learning Process: Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

UNIT-III

Back Propagation Networks – Architecture of a Back propagation Networks, Back propagation learning Input, Hidden, Output Layer computations, Calculation of error, Back propagation algorithm, Applications, Selection of various parameters in Back propagation networks

UNIT-IV

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT-V

Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

Text Books:

1. Neural Networks - A Comprehensive Foundation, Simon Haykin, Pearson Education Pub.
2. Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S. Rajsekaran, G.A. Vijayalakshmi Pai, Prentice Hall of India Pub.

Reference Books:

1. Artificial Intelligence and Intelligent Systems, N.P. Padhy, Oxford University Press.
2. Fuzzy Logic with Engineering Applications, Timothy J. Ross, Wiley India Pub.
3. Neural Networks, Kumar Satish, Tata McGraw Hill Pub.

NANO TECHNOLOGY
(ELECTIVE – 3)

Subject Code : 13ME4037 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand the basic physics behind quantum mechanics, structures in solids and bonding in solids.
- To know the different types of materials for the preparation of nano materials and properties of those nano materials.
- To understand the investigation and manipulating materials in the nano scale by using different microscopes.
- To understand different types of applications like nano biology and nano medicines.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Describe basic structures and bonding in nano-solids including silicon carbide, alumina and zirconia materials.
- Describe mechanical properties of nano-particles including strength and magnetic properties.
- Describe electrical and optical properties of nanoparticles.
- Study synthesis of nano-powders including electro-deposition.
- Study different microscopes for manipulating materials in the nano-scale sense.

UNIT-I

Introduction to Nano materials & Particles

Silicon Carbide: Application of Silicon carbide, nano materials preparation, Sintering of SiC, X-ray Diffraction data, electron microscopy sintering of nano particles,

Nano particles of Alumina and Zirconia: Nano materials preparation, Characterization, Wear materials and nano composites,

UNIT-II

Mechanical Properties: Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties.

Unit -III

Electrical Properties: Switching glasses with nanoparticles, Electronic conduction with nano particles.

Optical Properties: Optical properties, special properties and the coloured glasses

UNIT-IV

Process of synthesis of nano powders, Electro deposition, Important nano materials

UNIT-V:

Investigating and Manipulating Materials in the Nanoscale: Electron microscopics, scanning probe microscopics, optical microscopics for nano science and technology, X-ray diffraction.

Text Books:

1. Nano Materials, A.K. Bandyopadhyay, New Age Pub.

Reference Books:

1. Nano Essentials, T.Pradeep, Tata McGraw Hill Pub.

QUALITY & RELIABLE ENGINEERING
(ELECTIVE – 4)

Subject Code : 13ME4038 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- Demonstrate the approaches and techniques to assess and improve process and/or product quality and reliability.
- Introduce the principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring
- Illustrate the basic concepts and techniques of modern reliability engineering tools.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Illustrate basic concepts of quality engineering.
- Apply statistical process control and various types of control charts to quality engineering.
- Identify the optimum sampling method for different applications.
- Evaluate reliability of a system by test-Hazard mode. Predict reliability based on Weibull distribution.
- Evaluate reliability for complex systems.

UNIT-I:

Quality Value and Engineering-Quality Systems: Quality engineering in product design and production process-system design-parameter design-tolerance design, quality costs-quality improvement.

UNIT-II:

Statistical Process Control: X,R,P,C control charts, process capability, process capability analysis, process capability index.

UNIT-III:

Acceptance Sampling by Variables and Attributes: Design of sampling plans, single and double sampling plans, design of various sampling plans.

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UNIT-IV

Reliability: Evaluation by design tests-Hazard modes, Linear models. Failure data analysis, reliability prediction based on weibull distribution, Reliability improvement.

UNIT-V

Complex System: Reliability, Reliability of series, parallel and standby systems & complex systems & Reliability prediction and system effectiveness.

Text books:

1. Statistical Process Control, Eugene Grant, Richard Leavenworth, McGraw Hill Pub.
2. Quality Engineering in Production Systems, G Taguchi, McGraw Hill Pub.
3. Optimization &Variation Reduction in Quality, W.A. Taylor, Tata McGraw Hill Pub.

Reference books:

1. Jurans Quality Planning and Analysis, Frank. M. Gryna Jr., McGraw Hill Pub.
2. Taguchi Techniques for Quality Engineering, Philipposs, McGraw Hill Pub.
3. Reliability Engineering, L.S. Srinath, Affiliated East West Pub.
4. Reliability Engineering, E. Bala Guruswamy, Tata McGraw Hill Pub.

COMPUTATIONAL FLUID DYNAMICS
(ELECTIVE – 4)

Subject Code : 13ME4039 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To understand the basic numerical methods to solve fluid dynamics and heat transfer problems.
- To describe finite difference method and grid generation techniques.
- To explain governing equations of fluid flow and to classify fluid flows.
- To solve transient one dimensional and two dimensional heat conduction problems.
- To explain finite volume method and describe approximations for surface and volume integrals.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Discuss mathematical details in numerical techniques. Apply numerical methods for solving system of linear equations.
- Solve using finite difference method, steady and transient, heat conduction and convection heat transfer equations.
- Explain discretization, consistency and stability of Finite difference formulations for explicit & implicit, elliptic, parabolic and hyperbolic equations.
- Formulate governing Navier-Strokes equations of fluid and heat flow using direct method.
- Explain finite volume method. Describe approximations of surface and volume integrals, interpolations, implementation of boundary conditions.

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. 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.

UNIT-II

Finite Difference Applications in Heat conduction and Convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT-III

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT IV

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, Steady flow, dimensionless form of Momentum and Energy equations.

UNIT V

Conservative body force fields, stream function - Vorticity formulation.

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, Butterworth Pub.
2. Computational Fluid Dynamics - Basics with Applications, John. D. Anderson, McGraw Hill Pub.

Reference Books:

1. Computational Fluid Flow and Heat Transfer, Niyogi, Pearson Pub.
2. Fundamentals of Computational Fluid Dynamics, Tapan K. Sengupta, Universities Press.

UNCONVENTIONAL MACHINING PROCESSES
(ELECTIVE – 4)

Subject Code : 13ME4040 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To deliver knowledge on different unconventional machining techniques and their applications.
- To study the mechanism of various unconventional machining processes such as EDM, ECM, USM, abrasive jet machining, water jet machining and abrasive water jet machining.
- Understand the applications of plasma process for machine processes.
- State various parameters influencing the machining process.

COURSE OUTCOMES:

On completion of this course, students should be able to

- Describe the need for, and applications of UCMP. Explain the considerations in process selection. Describe USM.
- Describe AJM, WJM and AWJM processes along with material removal rate.
- Explain ECM processes like honing, deburring, ECG along with material removal rate and mechanics of cutting.
- Describe EDM, EDG and Wire EDM processes along with material removal rate and mechanics of cutting.
- Describe EBM, LBM and PAM processes along with material removal rate and mechanics of cutting.

UNIT-I

Introduction: Need for non-traditional machining methods – Classification of modern machining processes – considerations in process selection and applications.

Ultrasonic Machining: Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

UNIT-II

Abrasive Jet Machining: Water jet machining, abrasive water jet machining, abrasive flow machining, magnetic abrasive finishing - process parameters, material removal rate, mechanism analysis, process capabilities, abrasive particle size, limitations and applications.

UNIT-III

Electro-Chemical and Chemical Machining Processes: Fundamentals of electro chemical machining, electro chemical grinding (ECG, Electrochemical honing and deburring process, metal removal rate in ECM, tool design, surface finish and accuracy, economic aspects of ECM.
Fundamentals of Chemical machining, masks, etchants, advantages and applications.

UNIT-IV

Electric Discharge Machining (EDM: General principle and application, Electric Discharge Grinding (EDG and Wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, process parameters, selection of tool electrodes and dielectric fluids, surface finish and machining accuracy.

UNIT-V

Electron Beam Machining (EBM, Laser Beam Machining (LBM: basic principle and theory, process parameters, efficiency and accuracy, applications.

Plasma Arc Machining (PAM: Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industry.

Text Book:

1. Advanced Machining Processes, V. K. Jain, Allied Publications.

Reference Books:

1. Modern Machining Process, P.C. Pandey, Tata McGraw Hill Publications
2. Production Technology, HMT, Tata McGraw Hill Publications
3. New Technology, A. Bhattacharyya, Institution of Engineers(India) Publications

DESIGN FOR MANUFACTURING AND ASSEMBLY
(ELECTIVE – 4)

Subject Code : 13ME4041 **Internal Marks: 30**
Credits: 3 **External Marks: 70**

COURSE OBJECTIVES:

- To introduce the concept and application for design for manufacturing and assembly to practicing designers and manufacturing engineers as well as design students
- To discuss various fundamentals of assembly and design recommendations for product development

COURSE OUTCOMES:

On completion of this course, students should be able to

- Understand constraints of manufacturing processes that limit design possibilities. Describe general design rules for manufacturability and suitable materials.
- Describe design recommendations for machined and casted parts.
- Describe design recommendations for various processes like welding, forging, extrusion, sheet metal, punching, blanking, bending and deep drawing.
- Apply principles of DFA to increase manufacturing efficiency in assembly processes and automatic assembly transfer systems.
- Apply DFA principles for manual assemblies.

UNIT-I:

Introduction: Design philosophy steps in Design process - General Design rules for manufacturability - basic principles of designing for economical production - creativity in design. Materials: Selection of Materials for design - Developments in Material technology - Criteria for material selection - Material selection interrelationship with process selection process selection charts.

UNIT-II:

Machining Process: 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.

Metal Casting: Appraisal of various casting processes, selection of casting process, - general design considerations for casting - casting tolerances - use of solidification simulation in casting design - product design rules for sand casting.

UNIT-III:

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 dies forging design - parting lines of die drop forging die design - general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing - Keeler Goodman Forming Line Diagram - Component Design for Blanking.

UNIT-IV

Assemble Advantages: Development of the assemble process, choice of assemble method assemble advantages social effects of automation.

Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

UNIT-V:

Design of Manual Assembly: Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

Text Books:

1. Assembly Automation and Product Design, Geoffrey Boothroyd, Marcel Dekker Pub., NY.
2. Engineering Design - Material & Processing Approach, George E. Deiter, McGraw Hill Pub.

Reference Books:

1. Handbook of Product Design, Geoffrey Boothroyd, Marcel and Dekker Pub., New York.
2. Computer Aided Assembly, A Delbainbre.
3. Product Design for Manufacturing and Assembly, Geoffrey Boothroyd, Peter Dewhurst, Winston Ansthony Knight, CRC Press
4. Engineering Design, George E. Dieter, Linda C. Schmidt, McGraw Hill Pub.
5. Industrial Design, Materials and Manufacture Guide, J. Lesko, John Willy and Sons Pub.

INTERNSHIP

Subject Code : 13ME4203 **Internal Mark: 25**
Credits: 1 **External Marks: 50**

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IV Year B. Tech., II Semester

PROJECT WORK

Subject Code : 13ME4204 **Internal Marks: 60**
Credits: 6 **External Marks: 140**

PROJECT COURSE OUTCOMES

- CO1: Select relevant information from various sources including internet, library, journals, mechanical engineering magazines to define the problem.
- CO2: Comprehend principles pertaining to mechanical engineering that enables him to complete the project.
- CO3: Gain technology implementation skills by applying them to a new problem which may be the design and manufacture of a product, a research investigation, experimental, software or management project by using advanced equipment and software.
- CO4: Work as an individual and as a team including division of tasks, scheduling and monitoring the progress.
- CO5: Adhere to professional standards and ethics.
- CO6: Research various avenues for solving issues that arise during project implementation thereby inculcate lifelong learning.
- CO7: Write effective technical reports and demonstrate his/her work.

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