UNIVERSITY OF CALICUT

CURRICULUM

&

SYLLABUS

(I -IV SEMESTERS)

B. Tech.

(2024 SCHEME)

(Applicable to 2024 admission onwards)

Every course of B. Tech Program shall be placed in one of the ten categories as listed in table below.

Sl. No	Category	Credits
1	Humanities and Social Sciences including Management courses (HSMC)	8
2	Basic Science courses (BSC)	23
3	Engineering Science Courses (ESC)	25
4	Professional Core Courses (PCC)	77
5	Professional Elective Courses	9
6	Open Elective Courses	9
7	Internship, Seminar, Project work & Viva Voce	12
8	Mandatory Non-credit Courses (P/F) with grade	-
9	Laboratory Sessions & Mini Project	10
	Total Mandatory Credits	173
10	Value Added Course (Optional)	12

Semester-wise credit distribution shall be as below:

Semester	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Credits	21	24	21	20	22	24	20	21	173
Credits for Activity	1								1
Grand Total									**174**

Humanities and Social Sciences including Management courses (HSMC)			
Sl. No	**Title**	**Semester**	**Credit**
1	English for technical writing	1	2
2	Universal Human Values	2	3
3	Engineering Economics and Principles of Management	5	3
TOTAL CREDITS			**8**

Basic Science courses (BSC)			
Sl. No	**Title**	**Semester**	**Credit**
1	Engineering Mathematics I	1	4
2	Engineering Physics	1	4
3	Biology For Engineers	2	3
4	Engineering Mathematics II	2	4
5	Engineering Chemistry	2	4
6	Engineering Mathematics III	3	4
TOTAL CREDITS			**23**

Engineering Science courses (ESC)			
Sl. No	**Title**	**Semester**	**Credit**
1	Engineering Graphics	1	4
2	Programming For Problem Solving Using C	1	4
3	Basics of Mechanical & Civil Engineering	1	4
4	Mechanical & Civil Engineering Workshop	1	2
5	IDEA & Design Thinking Lab	1	1
6	Basics of Electrical & Electronics Engineering	2	4
7	Electrical & Electronics Engineering Workshop	2	2
8	Engineering Mechanics	3	4
TOTAL CREDITS			**25**

Professional Core courses (PCC)			
Sl. No	**Title**	**Semester**	**Credit**
1	Applied Thermodynamics	3	4
2	Fluid Mechanics	3	4
3	Electrical Technology	3	3
4	Heat & Mass Transfer	4	4
5	Hydraulic Machinery	4	4
6	Mechanics of Deformable Solids	4	4
7	Engineering Materials & Applications	4	3
8	Manufacturing Technology I	4	3
9	Mechanics of Machinery	5	4
10	Mechatronics, Robotics & Control	5	4
11	Gas Dynamics & Jet Propulsion	5	3
12	Manufacturing Technology II	5	3
13	Measurements & Metrology	5	3
14	Dynamics of Machinery	6	4
15	Machine Design I	6	4
16	Thermal Engineering	6	4
17	Computer Integrated Manufacturing	6	3
18	Machine Design II	7	4
19	Industrial Engineering & Systems Management	7	3
20	Refrigeration & Air-Conditioning	7	3
21	Power Plant Engineering	8	3
22	Production & Operations Management	8	3
TOTAL CREDITS			**77**

Internship, Seminar, Project work & Viva Voce			
Sl. No	**Title**	**Semester**	**Credit**
1	Internship	6	1
2	Project Phase I	7	2
3	Seminar	8	2
4	Project Phase II	8	4
5	Viva Voce	8	3
TOTAL CREDITS			**12**

Mandatory Non-credit Courses (P/F) with grade			
Sl. No	**Title**	**Semester**	**Credit**
1	Concepts of National Service	1	0
2	Environmental Science	2	0
3	Life skills & Professional Ethics	3	0
4	Constitution of India	4	0
TOTAL CREDITS			**0**

Laboratory sessions & Mini Project			
Sl No	**Title**	**Semester**	**Credit**
1	Computer Assisted Machine Drawing	3	1
2	Electrical Technology Lab	3	1
3	Strength of Materials Lab	4	1
4	Production Engineering Lab I	4	1
5	Fluid Mechanics & Machinery Lab	5	1
6	Production Engineering Lab II	5	1
7	Instrumentation Lab	6	1

8	Mini Project	6	1
9	CAD/CAM Lab	7	1
10	Thermal Engineering Lab	7	1
TOTAL CREDITS			**10**

MINORS:

Minor is an additional credential a student may earn if he/she does **11 credits** worth of additional learning in a discipline other than his/her major discipline of B.Tech. Degree. The objective is to permit a student to customize their Engineering degree to suit their specific interests. Upon completion of an Engineering Minor, a student will be better equipped to perform interdisciplinary research and will be better employable. The academic units offering minors in their discipline will prescribe the set of courses and/or other activities like projects necessary for earning a minor in that discipline.

A specialist basket of 4 courses is identified for each Minor. Each basket may rest on one or more foundation courses. A basket may have sequences within it, i.e., advanced courses may rest on basic courses in the basket. He/she accumulates credits by registering for the required courses, and if the requirements for a particular minor are met within the time limit for the course, the minor will be awarded. This will be mentioned in the Degree Certificate as **"Bachelor of Technology in xxx with Minor in yyy"**.

a. The individual course credits earned, however, will be reflected in the consolidated grade card.
b. Registration is permitted for Minor at the **beginning of fourth semester**.
c. Total credits required to award B.Tech with Minor is **184** (173 + 11).
d. The classes for Minor will be conducted along with regular academics.
e. **There won't be any supplementary examination for the courses chosen for Minor**.

HONOURS

Calicut University is providing this option for academically proficient students to acquire Honours. Students can attend various value added MOOC courses (Massive Open Online Courses) from NPTEL, COURSERA courses to earn a maximum of **12 additional credits** for getting 'Honours' degree in the discipline with a condition that he/she should have secured an aggregate of **8.0 CGPA** till final semester without any history of backlogs. The selected course must be in the same discipline.

a) The additional value-added MOOC courses can be of **8 – 12 weeks** duration.
b) **4 credits** will be awarded to a student on successful completion of each MOOC. Successful completion of a MOOC is considered only when a student scores a **minimum score of 60%** in the respective course.

Thus, a student will be eligible to get an undergraduate degree with 'Honours' when he/she successfully earns an additional requirement of 12 credits through the successful completion of **3 MOOCs**. However, the additional credits thus far earned by the student shall be included in the grade card but shall not be considered in calculating the CGPA. Upon completion of Honours, a student will be better equipped to perform research in his/her branch of engineering and allied sectors.

On successful achievement of 12 credits from the honours and 173 credits from their respective B-tech syllabus, the student will earn a total credit of 185 at the end of the programme which he/she will be eligible to get the Degree Certificate as **"Bachelor of Technology in Mechanical Engineering, with Honours."**

The details of the students eligible for conferring the Honours Degree must be sent to the university by the principal, with the details of his/her marks up to 7^{th} semester and the number of value-added courses and credits earned before the commencement of the 8^{th} semester university examination.

COURSE CODE AND COURSE NUMBER

Each course is denoted by a unique code consisting of two alphabets followed by two numerals like ME24 807 (P)**.** The first two letter code refers to the department offering the course. ME stands for Mechanical Engineering. The next two digits represent the year in which the syllabus is implemented, thus the digit 24 represents the year 2024. Out of the next three digits, the first digit represents the semester in which the subject belongs, Eg: in 807, 8 means 8^{th} semester and 07 is the 7^{th} subject in that semester. The last alphabet represents whether the subject belongs to the Practical category. Eg: (P) Means the subject belongs to the Practical category.

L-T-P-C STRUCTURE

Notations	Description
L	Lecture hours- For theory-based courses hours are represented in this form Eg: 3-0-0-0, means 3 hours lecture per week is dedicated for this subject
T	Tutorial hours- These hours may be assigned for solving numerical problems and allied activities. Eg: 3-1-0-0, means 1 hour per week is dedicated for this purpose.
P	Practical/ Drawing/Interactive session/Visits etc. These hours may be dedicated for conducting laboratory sessions, practical classes, Engg/machine drawing classes, interactive sessions, group discussions and even industrial visits pertaining to a specific subject for better learning. Eg: 0-0-1-0 means one hour is dedicated for the above mentioned purpose.
C	Credits- These are assigned based on the importance of the subject to the course. Eg. 0-0-1-1 means one credit is dedicated for the above mentioned purpose.

DEPARTMENTS

Each course offered by a department and their two-letter course prefix is given in the table

Departments and their codes

Sl. No	Department	Course Prefix
01	Computer Science & Engineering	CS
02	Electronics & Communication Engineering	EC
03	Electronics & Computer Science Engineering	ES
04	Electrical & Electronics Engineering	EE
05	Mechanical Engineering	ME
06	Printing Technology	PT

INDUCTION PROGRAM

A mandatory induction program for first semester students is designed for **one week**. This unique one week immersion foundation programme designed especially for the fresher's, includes a wide range of activities right from workshops, lectures and seminars by eminent people, visits to local areas, familiarization to branch, department and innovations, physical activity, yoga, literacy, sports tournaments, social work and much more. The programme is designed to mould students into well-rounded individuals, aware and sensitized to local and global conditions and foster their creativity, improve their level of confidence, to involve with the existing environment, inculcate values and ethics, and help students to discover their passion. Foundation Programme also serves as a platform for the fresher's to interact with their batch mates, faculty and seniors and start working as a team with them. The program is structured around the following four themes:

- **Values and Ethics**: Focuses on fostering a strong sense of ethical judgment and moral fortitude.
- **Creativity**: Provide channels to exhibit and develop individual creativity by expressing themselves through art, craft, music, singing, media, dramatics, and other creative designs/activities.
- **Leadership, Communication and Teamwork**: Develop a culture of teamwork and group communication.
- **Social Awareness**: Nurture a deeper understanding of the existing local and global environment and our role in that place as a responsible citizen of the world.

SCHEME OF 1st SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Subject Code	**Subject Name**	**Hours/Week**			**Marks**		**Duration of End Semester examination**	**Credits**
		L	**T**	**P**	**Internal**	**End semester**		
EN24 101	Engineering Mathematics I	3	1	0	50	100	3	4
PH24 102A	Engineering Physics	2	1	2	50	100	3	4
MC24 104A	Basics of Mechanical & Civil Engineering	2	2	0	50	100	3	4
GS24 106A	Engineering Graphics	2	0	3	50	100	3	4
EN24 108	English for Technical Writing	1	0	2	50	100	3	2
EN24 109	Concepts of National Service	3	0	0	100	-	-	0
MC24 110A(P)	Mechanical & Civil Engineering Workshop	0	0	4	50	100	3	2
EN24 112(P)	IDEA & Design Thinking Lab	0	0	2	100	-	-	1
	Total	**13**	**4**	**13**	**500**	**600**		**21**
		30						

SCHEME OF 2nd SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Subject Code	**Subject Name**	**Hours/Week**			**Marks**		**Duration of End Semester examination**	**Credits**
		L	**T**	**P**	**Internal**	**End semester**		
EN24 201	Engineering Mathematics II	3	1	0	50	100	3	4
CH24 202B	Engineering Chemistry	2	1	2	50	100	3	4
BE24 204B	Basics of Electrical & Electronics Engineering	2	2	0	50	100	3	4
PC24 206B	Programming for Problem Solving using C	2	1	2	50	100	3	4
EN24 209	Biology for Engineers	3	0	0	50	100	3	3
EN24 210	Universal Human Values	3	0	0	50	100	3	3
EN24 211	Environmental Science	2	0	0	100	-	-	0
BE24 212B(P)	Electrical & Electronics Engineering Workshop	0	0	4	50	100	3	2
	Total	**17**	**5**	**8**	**450**	**700**		**24**
		30						

SCHEME OF 3rd SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of End Semester examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
EN24 301	Engineering Mathematics III	3	1	0	50	100	3	4
EN24 302	Engineering Mechanics	3	1	0	50	100	3	4
ME24 303	Applied Thermodynamics	3	1	0	50	100	3	4
ME24 304	Fluid Mechanics	3	1	0	50	100	3	4
ME24 305	Electrical Technology	3	1	0	50	100	3	3
EN24 306	Life skills & Professional Ethics	3	1	0	100	-	-	0
ME24 307(P)	Computer Assisted Machine Drawing	0	0	3	50	100	3	1
ME24 308(P)	Electrical Technology Lab	0	0	3	50	100	3	1
	Total	**18**	**6**	**6**	**450**	**700**		**21**
		30						

SCHEME OF 4th SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of End Semester examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
ME24 401	Heat & Mass Transfer	3	1	0	50	100	3	4
ME24 402	Hydraulic Machinery	3	1	0	50	100	3	4
ME24 403	Mechanics of Deformable Solids	3	1	0	50	100	3	4
ME24 404	Engineering Materials & Applications	3	1	0	50	100	3	3
ME24 405	Manufacturing Technology I	3	1	0	50	100	3	3
EN24 406	Constitution of India	3	1	0	100	-	-	0
ME24 407	Minor Course*	3	0	0	50	100	3	3
ME24 408(P)	Strength of Materials Lab	0	0	3	50	100	3	1
ME24 409(P)	Production Engineering Lab I	0	0	3	50	100	3	1
	Total	**18**	**6**	**6**	**450**	**700**		**20**
		30						
Special Time Table will be allotted for Minor Course								

SCHEME OF 5th SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of End Semester examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
EN24 501	Engineering Economics & Principles of Management	3	1	0	50	100	3	3
ME24 502	Mechanics of Machinery	3	1	0	50	100	3	4
ME24 503	Mechatronics, Robotics & Control	3	1	0	50	100	3	4
ME24 504	Gas Dynamics & Jet Propulsion	3	1	0	50	100	3	3
ME24 505	Manufacturing Technology II	3	1	0	50	100	3	3
ME24 506	Measurements & Metrology	3	1	0	50	100	3	3
ME24 507	Minor Course*	3	0	0	50	100	3	3
ME24 508(P)	Fluid Mechanics & Machinery Lab	0	0	3	50	100	3	1
ME24 509(P)	Production Engineering Lab II	0	0	3	50	100	3	1
	Total	**18**	**6**	**6**	**400**	**800**		**22**
		30						
Special Time Table will be allotted for Minor Course								

SCHEME OF 6th SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of End Semester examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
ME24 601	Dynamics of Machinery	3	1	0	50	100	3	4
ME24 602	Machine Design I	3	1	0	50	100	3	4
ME24 603	Thermal Engineering	3	1	0	50	100	3	4
ME24 604	Computer Integrated Manufacturing	3	1	0	50	100	3	3
ME24 605	Professional Elective I	3	1	0	50	100	3	3
ME24 606	Open Elective I	3	1	0	50	100	3	3
ME24 607	Minor Course*	3	0	0	50	100	3	3
ME24 608(P)	Instrumentation Lab	0	0	3	50	100	3	1
ME24 609(P)	Mini Project	0	0	3	100	-	-	1
ME24 610(P)	Internship	0	0	0	100	-	-	1
	Total	**18**	**6**	**6**	**550**	**700**		**24**
		30						
Special Time Table will be allotted for Minor Course								

Professional Elective I		**Open Elective I**	
ME24 605(A)	Advanced Mechanics of Solids	ME24 606(A)	Product Design & Development
ME24 605(B)	Design of Jigs & Fixtures	ME24 606(B)	Quality Engineering & Management
ME24 605(C)	Operations Research	ME24 606(C)	Entrepreneurship & Business Analytics
ME24 605(D)	Non-Conventional Manufacturing Techniques	ME24 606(D)	Industrial Internet of Things
ME24 605(E)	Composite Materials	ME24 606(E)	Quantitative Technique for Engineers
ME24 605(F)	Tool Engineering and Design	ME24 606(F)	Disaster Management

OPEN ELECTIVE:

This elective subject is open to all students of various engineering disciplines. Any student can opt an elective subject based on his/her interest. These elective topics are of general in nature and focussed on thrust areas. The number of students that can be accommodated in an elective is limited to 50, the allotment can be on first come first serve basis.

INTERNSHIP:

Students need to undergo a minimum of 10-15 days internship in an Industry/Firm associated with rural technology and agriculture/Rural village to observe, identify and give suggestions to the problems related to mechanical or allied engineering sector in the society. In addition, the student may also work on a specified task or project which may be assigned to him/her. The students will have an opportunity to develop observational skills, develop confidence to identify and understand the issues related with machines and come up with solutions to rectify the same. This motive of the programme is ultimately focused on the mutual benefit to the students, industry and society. The outcome of the internship should be presented in the form of a report.

Total marks: 100, minimum marks required to get a pass the internship is 50, Mark distribution is as follows:

Attendance	**: 10**
Coordinator	**: 20**
Technical content of the report	**: 30**
Presentation	**: 40**

SCHEME OF 7th SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of End Semester examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
ME24 701	Machine Design II	3	1	0	50	100	3	4
ME24 702	Industrial Engineering & Systems Management	3	1	0	50	100	3	3
ME24 703	Refrigeration & Air-Conditioning	3	1	0	50	100	3	3
ME24 704	Professional Elective II	3	1	0	50	100	3	3
ME24 705	Open Elective II	3	1	0	50	100	3	3
ME24 706(P)	CAD/CAM Lab	0	0	3	50	100	3	1
ME24 707(P)	Thermal Engineering Lab	0	0	3	50	100	3	1
ME24 708(P)	Project phase I	0	0	4	100	-	-	2
ME24 709(P)	Project in Minor*	0	0	3	100	-	-	2
	Total	**15**	**5**	**10**	**450**	**700**		**20**
		30						
***Special Time Table will be allotted for Minor Course**								

Professional Elective II		**Open Elective II**	
ME24 704(A)	Advanced Automobile Engineering	ME24 705(A)	Marketing Management
ME24 704(B)	Acoustics & Noise Control	ME24 705(B)	Data Analytics for Engineers
ME24 704(C)	Industrial Tribology	ME24 705(C)	Industrial Safety Engineering
ME24 704(D)	Micro & Nano Manufacturing	ME24 705(D)	Technology Management
ME24 704(E)	Heat Transfer Equipment Design	ME24 705(E)	Computational Methods in Engineering
ME24 704(F)	Advanced Metal Joining Techniques	ME24 705(F)	Machine Learning & Applications

PROJECT PHASE I:

A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The guides may encourage socially relevant project which can be interdisciplinary in nature.

Faculty members and students can interact with members of the local body, practicing engineers, industry and research institutions, to identify the issues which are predominant in that area/state and needs immediate attention. Such issues may be categorized and converted into a research problem so that they can study the feasibility of doing a research project in that area. This method of addressing the problems of society will enhance the culture and social concern of the students. This initiative can produce engineers with social commitment.

The objective of project work is to enable the student to take up investigative study in the broad field which can be of interdisciplinary in nature, either fully theoretical/simulation/practical or involving both theoretical and practical work. The department can assign a group of maximum four students, under the guidance of a faculty to do the project work. Thus, the assigned faculty can constantly interact with these students and mentor them properly to gain confidence in taking up a research work and supporting them for making it a reality. This initiative is expected to provide a good base for the student(s) in taking up a research & development project.

Faculty themselves or along with students in the Institutions/departments can apply for project grants with research organizations like Kerala State Council for Science Technology and Environment (KSCSTE), Department of Science & Technology (DST) for doing projects. Faculty/students can also approach Agricultural, Veterinary, Fisheries, and Health Sciences Universities for doing projects in a variety of fields where they require technical support from the engineering sector. These types of funded research projects will improve the creativity and outlook of the students which will be beneficial to the society.

The assignment to normally include:

- Survey and study of published literature on the assigned topic.
- Preparing an action plan for conducting the investigation, including team work.
- Working out a preliminary approach to the problem relating to the assigned topic.
- Block level design documentation.
- Conducting preliminary Analysis/ Modelling/ Simulation/ Experiment/ Design/ Feasibility.
- Preparing a written report on the study conducted for presentation to the department.

Total marks: 100, minimum marks required to get a pass is 50, Mark distribution is as follows

Project Guide	**: 30**
Interim evaluation by the evaluation committee	**: 20**
Final presentation	**: 30**
Report evaluation by the evaluation committee	**: 20**

SCHEME OF 8th SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of End Semester examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
ME24 801	Power Plant Engineering	3	1	0	50	100	3	3
ME24 802	Production & Operations Management	3	1	0	50	100	3	3
ME24 803	Professional Elective III	3	1	0	50	100	3	3
ME24 804	Open Elective III	3	1	0	50	100	3	3
ME24 805(P)	Seminar	0	0	6	100	-	-	2
ME24 806(P)	Project Phase II	0	0	8	100	-	-	4
ME24 807(P)	Viva Voce	0	0	0	-	100	-	3
	Total	**12**	**4**	**14**	**400**	**500**		**21**
		30						

Professional Elective III		**Open Elective III**	
ME24 803 (A)	Non-Destructive Testing	ME24 804 (A)	Energy Engineering & Management
ME24 803 (B)	Renewable Energy Technology	ME24 804 (B)	Industrial Psychology & Organizational Behaviour
ME24 803 (C)	Finite Element Method	ME24 804 (C)	Supply Chain Management
ME24 803 (D)	Hybrid & Electric Vehicles	ME24 804 (D)	Project Planning & Management
ME24 803 (E)	Cryogenic Engineering	ME24 804 (E)	Business Economics
ME24 803 (F)	Lean Systems	ME24 804 (F)	Reliability & Industrial Maintenance

SEMINAR:

To encourage and motivate the students to read and collect recent and reliable information from their area of interest confined to the relevant discipline from technical publications including peer reviewed journals, conference, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. A faculty member can guide maximum of five students of his/her area of interest to have better interaction and creative support in guiding the seminar. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of internal members comprising three senior faculty members based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report.

Total marks: 100, minimum marks required to pass the seminar is 50, split-up of the marks are as follows

Attendance	**: 10**
Seminar Guide	**: 20**
Technical Content of the Report	**: 30**
Presentation	**: 40**

PROJECT PHASE II:

The objective of project phase II & dissertation is to enable the students to extend further the investigative study taken up in Project Phase I. This work can be either fully theoretical/practical or involving both theoretical and practical work, socially relevant initiatives (work from local body/village) funded project from a research organization. The project is under the guidance of a faculty (project guide) from the department alone or jointly with a supervisor drawn from R&D laboratory/Industry. This project work is expected to provide a good overall training for the students in research and development, execution of a theory into practical by facing the challenges with confidence by developing technical leadership. The assigned project work is normally evaluated based on the following points:

- Depth of knowledge in the topic assigned/work executed based on the report prepared under Phase I.
- Review and finalization of the approach to the identified problem relating to the assigned topic/work.
- Detailed Analysis/ Modelling/ Simulation/ Design/ Problem Solving/ Experiment as needed.
- Final development of product/process, testing, results, conclusions and future directions.
- Preparation of a paper for Conference presentation/publication in Journals, if available.
- Preparation of a dissertation in the standard format for evaluation by the department.
- Final presentation before the evaluation committee.

Total marks: 100, minimum marks required to pass 50, split-up of the marks are as follows

Project Guide : 30

Interim evaluation, by the evaluation committee : 20

Quality of the report evaluated by the above committee : 20

Final evaluation by a three- member faculty committee : 30

MINOR:

Students who have registered for **B.Tech Minor in Mechanical Engineering** can opt to study the courses listed below:

MINOR BASKET				
SEMESTER	**BASKET A**		**BASKET B**	
	SPECIALIZATION - MACHINE DESIGN		**SPECIALIZATION - THERMAL ENGINEERING**	
	SUBJECT CODE	**SUBJECT NAME**	**SUBJECT CODE**	**SUBJECT NAME**
S4	ME24 407A	Strength of Materials	ME24 407B	Fluid Mechanics & Hydraulic Machinery
S5	ME24 507A	Theory of Machines	ME24 507B	Thermodynamics
S6	ME24 607A	Machine Design	ME24 607B	Thermal Engineering
S7	ME24 709A(P)	Project in Minor	ME24 709B(P)	Project in Minor

ACTIVITY POINTS: -

The Tutor, HOD and Principal must ensure that the students have acquired the required mandatory activity points (100 points) and for lateral entry students (75 points) by the end of 8th semester. The accumulated activity points of all students must be consolidated and entered into the university portal by the college officials before the commencement of each semester university examinations.

Activities that a student can engage in and the maximum quantum of points that can be earned from them are listed below.

Annexure-I

(i)	NATIONAL LEVEL ACTIVITIES				
CODE	**NAME OF ACTIVITY**	**MAX ACTIVITY POINTS**	**POINTS DISTRIBUTION**	**ACTIVITY**	**MINIMUM DURATION**
NA1	NSO	70			2 SEM.
NA2	NCC	70			2 SEM.
NA3	NSS	70	• For ten days camp - **40 points** • Rest of the points will be allotted according **to the decision of NSS Program Officer**		2 SEM. **(Consider at S2 and S4)**
(ii)	**COLLEGE LEVEL ACTIVITIES**				
CA1	Active Member /Office bearer of professional Societies (Students Chapter)	30/40	• Executive Member - **40 points** • Core Coordinator - **30 points** • Sub Coordinator - **30 points** • Active Member - **10 points**	• IEEE • ASME • NASA • SAE etc. • College Association Chapters	4 SEM.
CA2	Elected office bearer of Student forums	30	• General Post - **30 points** • Department Secretary/ Year Representative - **25 points**	**General Post -** • Chairman • Vice Chairman • Secretary • Joint Secretary • UUC • Sports • Magazine Editor • Fine Arts Secretary	2 SEM.
CA3	Member/Captain of College Athletic/Games teams	20/30	•Captain - 2**0 points** •Member- **15 points** (Additional **10 points** awarded for national level)	• Cricket • Football • Volleyball • Chess etc.	2 SEM.

CA4	Executive Member of Students Clubs	20		• IEDC • TinkerHub • Hackclub • APT(E) etc.	2 SEM.
CA5	Volunteer for important College functions	25		• Placement cell coordinators can be considered	2 SEM.
CA6	Participant for important College functions	20			2 SEM.
CA7	Committee member/Organizer of Tech Fest/Cultural Fest/Conference	20/30	Committee member/Organizer - **20 points** (**30 points** will be awarded for national level/international level programs)		2 SEM.
CA8	Placed within top three in Paper presentation/ debate/ cultural competitions etc.	30	• First Prize - **30 points** • Second Prize- **25 points** • Third Prize- **20 points**	Technical Fest can also be considered	
CA9	Placed within three in State/National level Sports/Games	30	• First Prize- **30 points** • Second Prize -**25 points** • Third Prize - **20 points**		

(iii)	ENTREPRENEURSHIP				
EA1	Any Creative Project execution	40		Concerned dept. project coordinator should form a panel with external faculty from other dept. and get approved	
EA2	Awards for Projects	60			
EA3	Initiation of Start-ups	60			
EA4	Attracted Venture Capital	80			
EA5	Filed a Patent	80	• Patent -Filed - **50 points** • Patent-Published - **60 points** • Patent-Approved - **70 points** • Patent-Licensed - **80 points**		
EA6	Completed Prototype Development	80	• Prototype developed and tested - **60 points** • Completed prototype development - **80 points**	Concerned dept. project coordinator should form a panel with external faculty from other dept. and get approved	
(iv)	**SELF INITIATIVES**				
SA1	Attended College/University level conferences	25		• Seminars • Workshop can be considered	4 SEM.

SA2	Attended National/International Conference	30		• Seminars • Workshop • STTPs conducted at IITs/NITs/Universities can be considered	4 SEM.
SA3	Published /got an Award for a technical paper	30/40	•Publication- **30 points** •Awards **- 40 points**		
SA4	Organizer of Student technical Conference/Competition	30			
SA5	Foreign Language skills	50		• TOEFL • IELTS etc.	
SA6	Online courses taken & completed	50		10 hours per week or 1 month course duration can be considered	

EN24 101	ENGINEERING MATHEMATICS I	3-1-0-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To familiarize with functions of several variables that is essential in most branches of Engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To familiarize the student with concept of vector differentiation.
- To familiarize the student with concept of vector integration.
- To develop the essential tool of Matrices and Linear Algebra in a comprehensive manner.

SYLLABUS:

Module I: Multivariable Calculus (10 hours)

Functions of several variables- Limit, continuity and partial derivatives- Partial derivatives of functions of two variables- Implicit partial differentiation- Partial derivatives of functions of more than two variables- Higher order partial derivatives- total derivative- Maxima, minima and saddle points.

Module II: Multiple integrals and their applications (10 hours)

Double integrals (Cartesian and polar coordinates) - Change of order of integration of double integrals- change of variables (Cartesian to polar) - triple integrals- volume of solids, change of variables (rectangular to cylindrical).

Module III: Vector differential calculus (10 hours)

Vector functions of a single variable- Differentiation of vector functions- scalar and vector Fields- gradient of scalar field- divergence and curl of vector fields- relation between the vector differential operators.

Module IV: Vector integral calculus (10 hours)

Integration of vector functions- scalar line integrals- surface and volume integrals of vector Functions- Gauss divergence theorem- Stokes theorem- Greens theorem (without proof).

Module V: Matrices (12 hours)

Rank of a matrix- Solution of System of linear equations- Homogeneous and non-Homogeneous, Hermitian, skew-Hermitian and Unitary matrices- Eigen values and Eigen Vectors- Cayley Hamilton theorem- Diagonalisation of matrices.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Develop skills of using the derivatives to find critical points, inflection points and local extrema.
- Acquire the basic concept of partial differentiation and its applications in engineering physical phenomena involving continuous changes of variables and parameters.

- Acquire the knowledge of vector differentiation.
- Develop skills for using integration of vector functions.
- Use matrices and determinants for solving system of linear equations and applying it in engineering problems.

TEXT BOOKS:

1. G.B. Thomas, R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. N.P. Bali, Manish Goyal, A text book of Engineering Mathematics, Laxmi Publication Reprint, 2008.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T, Engineering Mathematics for First year, Tata McGraw-Hill, New Delhi, 2008.
3. Ramana B.V, Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.
4. D.Poole, Linear Algebra, A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
6. K.B.Dutta, Matrices and Linear Algebra, PHI Learning Pvt Ltd, New Delhi, 2003.
7. M.D.Raisinghania, Vector Analysis, S.Chand & Co, India, 1997.
8. Jack L Goldbeg, Matrix Theory with applications, Mc Graw Hill, Newyork, 1992.
9. A.K.Hazra, Matrix Algebra, Calculus and generalized inverse, Viva Books, New Delhi.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

PH24 102A	ENGINEERING PHYSICS	2-1-2-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To impart the basic concepts and ideas in physics.
- To develop scientific attitudes and enable the students to correlate the concepts of physics with the core programs.
- To explain the dual nature of radiation and matter.
- To apply Schrodinger's equation to solve finite and infinite potential problems and apply quantum ideas at the nanoscale.
- To understand the Maxwell's equations for electromagnetic waves

SYLLABUS:

Module I: **(12 hours)**

Damped harmonic oscillator- derivation of equation of motion and its solution, under damped oscillators- energy decay in damped harmonic oscillator, Quality factor (qualitative)- Forced harmonic oscillator: equation of motion and its solution (No derivation), Amplitude resonance - Electrical analogy of mechanical oscillators. Transverse and Longitudinal waves - Transverse waves on a stretched string; the wave equation on a string, derivation for the velocity and frequency of transverse vibrations on a stretched string.

Practical Work:

Melde's string apparatus- Measurement of frequency in the transverse and longitudinal mode.

Module II: **(10 hours)**

Interference of reflected light in thin films- Interference in thin films (Cosine law) - Derivation of the conditions of constructive and destructive Interference - Air Wedge- Determination of thickness of a thin wire - Antireflection coatings. Fresnel and Fraunhofer classes of diffraction - Diffraction grating - Grating equation- Rayleigh's criterion for limit of resolution - Resolving power of a grating with expression (no derivation), Comparison of interference and diffraction.

Practical Work:

1. Wavelength of sodium light by Newtons Ring method.
2. Wavelength of mercury spectral lines using diffraction grating and spectrometer.
3. Diameter of a thin wire or thickness of a thin wire by Air-wedge method.

Module III: **(10 hours)**

Wave-Particle dualism- de Broglie hypothesis, de-Broglie wavelength- Wave function- Admissibility conditions, Physical significance, Probability density, Normalization condition - Time dependent Schrodinger wave equation - Time independent Schrodinger wave equation, Applying the Schrodinger equation. Nanophysics- Quantum confinement in one dimension, two dimensions and three dimensions- Quantum well, Quantum wires and Quantum dots.

Module IV: **(10 hours)**

Physics of gradient, divergence and curl- Gauss's divergence theorem and Stoke's theorem- Equation of continuity, Deduction of Maxwell's equations in vacuum - Electromagnetic waves: Electromagnetic wave equation in free space, velocity of Electromagnetic waves in free space.

Module V: **(10 hours)**

Laser -Properties of laser - Absorption and Emission of radiation - Spontaneous and Stimulated emission of radiation - population inversion - metastable states - Basic components of laser; active medium, pumping mechanism, optical resonant cavity - Construction and working of Ruby laser - Applications of lasers in Engineering (qualitative ideas). Acoustics - Characteristics of Sound-Pitch or frequency-Loudness or Intensity - Quality or timbre, Absorption coefficient, Reverberation and Echo - Reverberation time - Sabine's formula (no derivation), Factors affecting architectural acoustics and their remedies.

Practical Work:

Wavelength of laser using Grating, standardize the Grating using sodium light.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Familiarize with the principles of Physics and its significance in engineering systems and technological advances.
- Apply the concept of interference and diffraction for determination of wavelength of unknown sources.
- Apply the basic principles of Quantum Mechanics by determining the energy Eigen values and Eigen functions of a particle in a box.
- Apply Maxwell's equations in estimating the speed of light.
- Use low power lasers by doing optical and fiber optical experiments.

TEXT BOOKS:

1. M.R.Seenivasan, Physics for Engineers, New Age Publishers, 1996 Edition.
2. Beiser A, Concepts of Modern Physics, McGraw Hill India Ltd.
3. Brijlal, Subramanyam, A Text Book of Optics, S.Chand & Co.
4. Mehta V K, Principles of Electronics, S.Chand & Co.
5. Rajendran V, Marikani A, Physics I, Tata McGraw Hill Co Ltd.
6. T. Pradeep, "Nano:The Essentials'', McGraw Hill India Ltd, 2007.
7. Griffiths "Introduction to Electrodynamics" 4th Edition, Pearson.

REFERENCE BOOKS:

1. Aruldhas G, Engineering Physics, PHI Ltd.
2. Bhattacharya, Tandon, Engineering Physics, Oxford India.
3. Dominic, Nahari, A Text Book of Engineering Physics, Owl Books Publishers
4. Hecht E, Optics, Pearson Education.
5. Mehta N, Applied Physics for Engineers, PHI Ltd.
6. Palais J. C, Fiber Optic Communications, Pearson Education.

7. Pandey B. K, Chathurvedi S, Engineering Physics, Cengage Learning.
8. Philip J, A Text Book of Engineering Physics, Educational Publishers.
9. Premlet B, Engineering Physics, McGraw Hill India Ltd.
10. Sarin A, Rewal A, Engineering Physics, Wiley India Pvt Ltd.
11. Sears, Zemansky, University Physics, Pearson.
12. Vasudeva A. S, A Text Book of Engineering Physics, S. Chand & Co.
13. Kakani A. S, A Text Book of Electronics, New Age International publishers, 2000 Edition.
14. Md.N.Khan, S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

10% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

30% - Lab Performance including Test and Record

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

MC24 104A	BASICS OF MECHANICAL & CIVIL ENGINEERING	2-2-0-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To satisfy the technical requirement of understanding various principles associated with civil Engineering.
- To make the students persuade the civil engineering works that is an integral part of Engineering professional's life irrespective of the discipline.
- To gain knowledge in metal casting, joining and machining process.
- To understand basic thermodynamic principles and laws to analyze and design thermodynamic systems.
- To familiarize various theories behind the working of hydraulic machines.

SYLLABUS:

Module I: **(10 hours)**

Scope of civil engineering

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society - Specialized sub-disciplines in Civil Engineering- Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering- Introduction to types of buildings as per NBC - Structural Components of a residential building and their functions.

Building planning

Introduction to planning of residential buildings- Principles of building planning - Selection of site for buildings, Orientation of a building.

Introduction to surveying

Surveying: Objects- classification- principles- Modern Tools of Surveying and Mapping- Total Station, Global Positioning System, Remote Sensing and Geographic Information System.

Module II: **(10 hours)**

Modern trends in civil engineering

Robotics and Automation in construction industry - Artificial Intelligence and Machine Learning techniques- Applications of AI in Civil Engineering- 3D Printing in Prefabricated Construction- (BIM) Building Information Modelling (Only brief description is expected)- civil engineering aspects only.

Civil engineering materials

Brief description of Engineering properties and applications of the following construction materials- Cement- concrete- steel- Reinforced Cement Concrete Fundamentals (Only brief description is expected) - modern materials (Study on laboratory tests not expected, detailed manufacturing processes of materials not expected).

Module III: **(12 hours)**

Manufacturing Process: Basic description of the manufacturing processes- Sand Casting, Forging, Rolling, Extrusion and their applications.

Metal Joining Processes: Types of welding, Description with sketches of Arc Welding, Soldering, Brazing and their applications.

Basic Machining operations: Turning, Drilling, Milling and Grinding.
Description about working with block diagram of: Lathe, Drilling machine, Milling machine, CNC Machine. Principle of CAD/CAM, Rapid and Additive manufacturing.

Module IV: (10 hours)

Analysis of thermodynamic cycles: Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net work and efficiency.
IC Engines: CI, SI, 2- Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines (Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines.

Module V: (10 hours)

Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems); Definitions of dry, wet and dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.
Description about working with sketches of: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine.
Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Understand the basics of civil engineering works that an engineer come across in professional as well as personal life.
- Prepare the layouts of buildings and other infrastructures, obtain understanding of the basic elements of the transportation system, modern techniques for construction industry.
- Get an overview of metal casting, joining and machining process.
- Analyze thermodynamic cycles and calculate its efficiency.
- Describe the working of hydraulic machines.

TEXT BOOKS:

1. Dr. B.C. Punamia, Surveying Vol. I, II, Laxmi Publications.
2. Gurcharan Singh, Building planning, designing and scheduling, Standard Publishers.
3. Rangwala, S. C., Dalal K. B, Building Construction., Charotar Publishing house
4. S.S Bhavikatti., Basic Civil Engineering., New Age International Pvt.Ltd Publishers
5. Plevris, Vagelis, Ahmad, Lagaros, Artificial intelligence and machine learning techniques for civil engineering, IGI Global publishers.
6. Benjamin,J., Basic Mechanical Engineering, Pentex Books, 9th Edition, 2018
7. Balachandran P., Basic Mechanical Engineering, Owl Books

REFERENCE BOOKS:

1. T.P Kanetkar, S.V Kulkarni, Surveying and Levelling Vol. I and II

2. James M. Anderson, Edward M. Mikhail, Surveying Theory and Practice (Seventh Edition)
3. T.M Lillesand, R.W Kiefer. A, J.W Chipman , Remote sensing and Image interpretation, 5th edition
4. S.V.Deodhar, Building Science and Planning
5. Keeble Lewis, Principles of Town planning
6. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
7. Clifford, M., Simmons, K., Shipway, P., An Introduction to Mechanical Engineering Part I -CRC Press
8. Roy, Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd., Mumbai.
9. Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI
10. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

GS24 106A	ENGINEERING GRAPHICS	2-0-3-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing.
- To impart knowledge on the projection of points, lines and plane surfaces.
- To improve the visualization skills for better understanding of projection of solids.
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To enable the students to draw the different machine elements / mechanical parts.

SYLLABUS:

Module I: **(10 hours)**

Engineering Graphics- Introduction- Drawing instruments and their use- lines, Lettering and dimensioning- Scales- Familiarization with Standard Code of practice for general engineering drawing. - Projections of points in different quadrants. Projections of straight lines - True length and inclinations of a line with reference planes. Traces of lines- Line parallel to both reference planes- Perpendicular to one of the reference planes- Inclined to one and parallel to other reference plane- Inclined to both the reference planes- Rotating line method- Rotating plane method.

Module II: **(12 hours)**

Projections of planes- lamina of geometrical shapes- Plane lamina parallel, inclined and perpendicular to the reference planes- Inclined to one and perpendicular to the other reference plane- Inclined to both the reference planes- Inclined to the two reference planes but perpendicular to the profile plane.

Module III: **(13 hours)**

a) Projections of Solids of revolution and Frustums- Projections of solids with axis parallel to one and inclined to the other reference plane- Axis inclined to both the reference planes- Projections of solids on auxiliary planes (Solids to be drawn: Cube, Prisms, Pyramids, Cone and Cylinder).

b) Sections of solids - Sections by cutting planes parallel to the reference planes - Cutting plane inclined to one and perpendicular to other reference plane- True shape of the section by projecting on auxiliary plane (Solids to be drawn: Cube, Prisms, Pyramids, Cone and Cylinder).

Module IV: **(13 hours)**

a) Development of surfaces of solids- Development of Polyhedra, Cylinder, Cone and sectioned solids- Development of solids having hole or cut.

b) Introduction to isometric projection- Isometric scale- Isometric views- Isometric projections of Prisms, Pyramids, Cylinder, Cone, Spheres, sectioned solids.

Module V: **(12 hours)**

a) Introduction to perspective projections- Visual ray method of drawing perspective projection - Perspective views of plane figures such as polygons and circles- Perspective views of solids like Prisms and Cube.

b) Conventional representation of threaded fasteners- Drawing of nuts, bolts, locking arrangements of nuts- Foundation bolts.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Familiarise with the Fundamentals of Engineering Drawing standards.
- Interpret 3D shapes from orthographic projections of objects and to make orthographic projections of any object.
- Draw the sectional view of the solids.
- Make developments of surfaces and solids.
- Create drawings using Visual ray method and to draw conventional representation of threaded fasteners.

TEXT BOOKS:

1. P.I Varghese, Engineering Graphics, VIP Publications, Thrissur.
2. N D Bhatt, "Engineering Drawing", Charotar Publications.

REFERENCE BOOKS:

1. G.B. Thomas, R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. John.K.C, Engineering graphics, PHI Learning Pvt, Ltd. 2009.

Internal Continuous Assessment (Maximum Marks-50)

60% - Assignments (minimum 10 Drawing sheets, 2 from each module) plus two assignments on CAD.

30% - Tests (minimum 2)

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

Q 1. Two questions (a) and (b) of 20 marks each from module I, with choice to answer any one.

Q 2. Two questions (a) and (b) of 20 marks each from module II, with choice to answer any one.

Q 3. Two questions (a) and (b) of 20 marks each from module III, one from module III(a) and one from module III(b), with choice to answer any one.

Q 4. Two questions (a) and (b) of 20 marks each from module IV, one from module IV(a) and one from module IV(b), with choice to answer any one.

Q 5. Two questions (a) and (b) of 20 marks each from module V, one from module V(a) and one from module V(b), with choice to answer any one.

EN24 108	ENGLISH FOR TECHNICAL WRITING	1-0-2-2

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To provide a learning environment to practice listening, speaking, reading and writing skills.
- To develop vocabulary and language skills relevant to engineering as a profession.
- To assist the students in carrying 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.

SYLLABUS:

Module I: **(8 hours)**

Basic Writing Skills: Sentence Structures, Use of phrases and clauses in sentences- Importance of proper punctuation- Parts of Speech- Identifying Common Errors in Writing- Subject- verb agreement.

Module II: **(12 hours)**

Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages- Technical report writing: Synopsis writing, formats for reports, Introductory report, Progress report, Incident report, Feasibility report, Marketing report, Field report, Laboratory test report, and Project report.

Module III: **(12 hours)**

Technical Writing: Definition and Preparation of Manual- Memorandum- Agenda, Minutes of a Meeting- PowerPoint Presentation- Written Communication: Note making and taking, narrating events chronologically- Writing resumes and cover letters.

Module IV: **(8 hours)**

Writing Practices: Essay Writing- Formal Letters- Reading Comprehension- Precis Writing- Memos.

Module V: **(8 hours)**

Oral Communication (interactive practice sessions in Language Lab) - Listening Comprehension- Vocabulary Games- Pronunciation- Intonation, Stress and Rhythm- Common Everyday Situations: Conversations and Dialogues- Group Discussions- Interviews - Oral Presentation- Debates.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Heighten their awareness of correct usage of English grammar in writing and sounds in speaking.
- Write official correspondence i.e., reports, memos, letters and e-mails and prepares impressive curriculum vitae and resumes.
- Enhance their verbal communication skills through free speeches, role plays, activities and interactions.
- Improve their self-esteem and captivate them to be effective in facing interview boards confidently.
- Create effective presentations in front of different clusters.

REFERENCE BOOKS:

1. Kul Bhushan Kumar, Effective Communication Skills, Khanna Book Publishing, 2022.
2. F.T. Wood, Remedial English Grammar, Macmillan, 2007.
3. William Zinsser, On Writing Well, Harper Resource Book, 2001.
4. Liz Hamp-Lyons, Ben Heasly, Study Writing, Cambridge University Press, 2006.
5. Sanjay Kumar, Pushpa Lata, Communication Skills, Oxford University Press, 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.
7. William Stallings, Data and Computer Communications, 8th Ed, Pearson Education.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

10% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

30% - Lab Performance

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

EN24 109	CONCEPTS OF NATIONAL SERVICE	3-0-0-0

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- Understand the community in which they work.
- Identify the needs and problems of the community and involve them in problem solving.
- Develop among themselves a sense of social and civic responsibility and utilize their knowledge in finding practical solutions to individual and community problems.
- Develop competence required for group living and sharing of responsibilities and gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
- Develop capacity to meet emergencies and natural disasters and practice national integration and social harmony in general.

SYLLABUS:

Module I: **(10 hours)**

Basic Concepts of NSS: History, Philosophy, Definition, Aims and Objectives- Emblem, Flag, Motto, Song, Badge, NSS day etc, - Organizational structure (from national to regional level) Roles and responsibilities of various NSS functionaries.

Environmental Issues: Environment conservation, enrichment and sustainability Climate change, global efforts for environment conservation. Conservation of natural resources (Rain water harnessing) - Renewable energy: Solar, Air and Water. Waste land development, soil conservations and afforestation.

Module II: **(10 hours)**

Understanding Youth: Definition, profile of youth, categories, issues, challenges and opportunities for youth- Youth as an agent of social change- Youth development programmes at University level, college level, National level, State level and voluntary sector (NGO).

Role of Youth Leadership: Meaning, types, importance, role and traits of youth leadership Qualities of good leaders- Role of youth in Peace- building, conflict resolution, and nation-building.

Module III: **(7 hours)**

Youth and Health: Healthy lifestyles- Alcohol, Smoking and drug abuse- Stress management.

Youth and Crime: Sociological and psychological factors influencing youth crime- Juvenile justice. Peer mentoring in preventing crimes- Awareness about anti-ragging- Cyber-crime and its prevention.

Module IV: **(10 hours)**

Family and Society: Concept of family, community and society- Dynamics and impacts of growing up in the family- Human values- Decline of value and family system- Gender discrimination issues Regionalism and Caste system in India.

Health and Hygiene: Definition, needs and scope of health education- National health programme Food and nutrition- Reproductive health- Safe drinking water, water borne diseases and sanitation. Concept of hygiene and maintenance of hygiene- Health and hygiene awareness programmes for community- Social service programmes for child welfare, physically and mentally challenged.

Module V: (8 hours)

Awareness Programme in Community: Road safety, Food safety programme, Cyber safety, Substrate abuse safety and Drugs safety programme- Blood donation, Eye donation, Organs donation, and Body donation awareness programme- AIDS/HIV awareness and Stress management programme.

Disaster Management: Introduction and classification of disasters- Role of youth Disaster Management Pre-disaster: Educating the community- Sensitizing Government servants during the disasters.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Understand the importance of his / her responsibilities towards society.
- Analyse the environmental and societal problems/issues and to design solutions for the same.
- Evaluate the existing system and to propose practical solutions for the same for sustainable development.
- Implement government or self-driven projects effectively in the field.
- Develop capacity to meet emergencies and natural disasters and practice national integration and social harmony in general.

REFERENCE BOOKS:

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. Rashtriya Seva Yojana Sankalpana, Prof. Dr. Sankay Chakane, Dr. Promad Prabhakar, Diamond Publication, Pune.
3. National Service Scheme Manual for NSS District Coordinators, National Service Scheme cell, Dept. of Higher and Technical Education, Mantralaya.
4. Annual report of National service Scheme (NSS) published by dept. of Higher and Technical Educational, Mantralaya.
5. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.
6. Case material as a Training Aid for Field Workers, Gurmeet Hans.
7. Social service opportunities in hospital, Kapil K. Krishnan, TISS.
8. New Trends in NSS, Research papers published by University of Pune.

Internal Continuous Assessment (Maximum Marks-100)

50%- Assessment and Evaluation pattern
50%- Activities

MC24 110A(P)	MECHANICAL & CIVIL ENGINEERING WORKSHOP	0-0-4-2

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To provide experience on plotting, measuring/determining horizontal distances, level differences between stations and horizontal angles.
- To provide experience on setting out for small buildings, masonry construction and necessary skills for planning, preparing and executing an engineering project.
- To inculcate engineering aptitude, confidence and experience towards technical skills.
- To train the students mentally and physically for industries.
- To impart knowledge and technical skills on basic manufacturing methods.

SYLLABUS:

List of experiments
(Minimum 10 experiments out of 14)

1. Chain and Cross staff Surveying - Study of chain and accessories, calculate the area of Built up Space and a small parcel of land using chain and cross-staff.
2. Levelling - Study of levelling instruments, Determination of reduced levels of five or six points in the field.
3. Theodolite - Study of Theodolite, Measuring horizontal and vertical angles.
4. Brick Masonry - Elevation and plan (Construct a one and half thick brick wall of 50cm height and 60cm length using English bond). Use spirit level to assess the tilt of walls.
5. Total Station Survey - Site plan preparation (Determination of area and traversing)
6. Setting out of a building: Computation of plinth area / built up area, Floor area / carpet area - for a simple single storeyed building (single room only); The student should set out a building as per the given building plan using tape only.
7. Collection and study of various civil engineering drawings like plan, elevation, structural drawing, plumbing drawing etc.
8. Carpentry: Introduction to workshop safety and personal protective equipment (PPE).Study of carpentry tools and their uses. Practice in marking, sawing, chiselling, and planning. Introduction to different types of joints and their applications. Hands-on project: Building a simple wooden structure or piece of furniture. Introduction to power tools used in carpentry.
9. Fitting: Workshop safety and tool usage guidelines. Study of fitting tools, including chisels, files, saws, and drills. Techniques for chipping, filing, cutting, drilling, and tapping. Practice in creating male and female joints and stepped joints. Introduction to precision measuring techniques. Use of micro meters and callipers for accurate measurements.
10. Smithy: Safety procedures for the smithy workshop. Study of smithy tools and equipment. Forging of square prisms and hexagonal bolts. Heat treatment and tempering of metals. Hands-on project: Forging a basic tool or decorative item.

11. Foundry: Workshop safety and sand preparation techniques. Study of foundry tools and equipment. Practice in sand moulding and casting. Introduction to different casting methods (e.g., sand casting, investment casting). Hands-on project: Creating a casting mould and pouring molten metal.
12. Sheet Metal Work: Safety guidelines for sheet metal work. Study of sheet metal tools and equipment. Selection of different gauge sheets. Types of joints, trays, and containers in sheet metal work. Hands-on project: Design and build a sheet metal enclosure or housing.
13. Welding: Introduction to welding safety and precautions. Study of welding tools and equipment. Different types of welding joints. Practice in welding various joints. Introduction to welding processes (e.g., MIG, TIG, stick welding) Hands-on project: Welding a small assembly.
14. Materials and Properties: Overview of common engineering materials and their properties. Introduction to material selection and its importance in engineering design.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Name different devices and tools used for civil engineering measurements.
- Demonstrate the steps involved in basic civil engineering activities like plot measurements, setting out operation, evaluating the natural profile of land and undertaking simple construction works.
- Carpentry: Basic use of carpentry tools, execution of precision tasks (e.g., marking, sawing, chiseling), creation of diverse joints, and safe operation of power tools.
- Fitting: Mastery of fitting operations (e.g., chipping, filing, and cutting), accurate construction of male/female joints, and application of precision measurement techniques.
- Smithy: Competence in using smithy tools, forging square prisms and hexagonal bolts, and understanding heat treatment of metals.
- Sheet Metal Work: Selection of suitable gauge sheets, skillfull joining techniques, and effective fabrication of trays and containers.
- Welding and Metal Properties: Knowledge of welding safety, proficiency in various welding joints, and comprehension of metal properties in fabrication.
- Fitting Tools and Operations: Recognition and explanation of fitting tool functions, precise execution of operations (e.g., marking, sawing, drilling), and understanding the applications of male and female joints.
- Materials and Properties: comprehensive understanding of engineering materials and their properties, enabling them to make informed material selections crucial for effective engineering design.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and Viva Voce

30% - Tests

10% - Attendance and Regularity in the lab

Semester End Examination (Maximum Marks-100)

70% - Procedure, conducting experiment, result, tabulation and inference
20% - Viva Voce
10% - Fair record

EN24 112(P)	IDEA & DESIGN THINKING LAB	0-0-2-1

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To cultivate creativity and innovation among students.
- To develop problem-solving skills using design thinking methodologies.
- To foster collaborative teamwork and effective communication.
- To provide practical experience in idea generation and prototyping.
- To prepare students for real-world problem-solving scenarios.

SYLLABUS:

List of experiments
(Minimum 9 experiments out of 12)

1. Introduction to Idea and Design Thinking, Overview of innovation and design thinking, Historical context and case studies and Understanding the design thinking process.
2. Empathize and Define, Conducting user interviews, identifying problems and needs, defining problem statements.
3. Ideation, Techniques for brainstorming, Idea selection and prioritization, Prototyping and testing ideas.
4. Teamwork and Collaboration, Building effective teams, Communication and collaboration skills, Group dynamics and conflict resolution.
5. Prototyping and User Testing, Rapid prototyping techniques, conducting user testing, Iterative design.
6. Design Thinking in Real-World Context, Applying design thinking to various industries, Ethical considerations in design.
7. Refining prototypes.
8. Testing- Documentation and the Pitching.
9. Software Development using Scrum Framework- Scrum tools- Case Studies.
10. DevOPs the advanced process of software engineering for faster problem resolution and team collaboration.
11. Agile software methodology for faster development of quality software.
12. Unresolve different transformations of a product or a service through brainstorming and incremental approach, etc.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Foster a mindset for innovation by providing insights into how innovative ideas have been generated and implemented through the study of design thinking and historical case studies.
- Help students to generate a wide range of creative solutions to address the identified problems, fostering creativity and divergent thinking.

- Enhance problem-solving skills by equipping students with the ability to conduct user interviews, identify problems, and define problem statements effectively, enabling them to empathize with users.
- Develop essential interpersonal skills necessary for successful collaboration in diverse team settings.
- Create prototypes quickly, gather feedback from users, and refine their solutions based on user needs, ensuring that the final product or service is user-centric and meets the desired outcomes.

TEXT BOOK:

Christian Muller- Roterberg, Design Thinking for Dummies, John Wiley & Sons Publications.

Internal Continuous Assessment (Maximum Marks-100)

30% - Individual Assignments
40% - Group Projects
15% - Final Presentation
15% - Attendance and Participation

EN24 201	ENGINEERING MATHEMATICS II	3-1-0-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To introduce effective mathematical tools for the solutions of differential equations of first order that model physical process.
- To introduce effective mathematical tools for the solutions of differential equations of higher order.
- To develop the tool of Power series for learning advanced Engineering Mathematics.
- To introduce Laplace transforms of elementary functions and solution of differential equations using Laplace transforms.
- To develop the tool of Fourier transforms for learning Advanced Engineering Mathematics.

SYLLABUS:

Module I: First order ordinary differential equations (10 hours)

Homogeneous differential equations, differential equations reducible to homogeneous, Exact, linear and Bernoulli's equations. Applications of differential equations of first order - orthogonal trajectories.

Module II: Ordinary differential equations of higher order (10 hours)

Second order linear differential equations with constant coefficients, method of variation of parameters, second order linear differential equations with variable coefficients-Cauchy's linear differential equations.

Module III: Power series (10 hours)

Taylor's and Maclaurin's theorems, Power series, Taylor's Series, Maclaurin's series, series for exponential, trigonometric, hyperbolic and logarithmic functions. Leibnitz formula for n^{th} derivative of product of two functions

Module IV: Laplace Transforms (10 hours)

Laplace transform-Elementary properties -Inverse Laplace transform- Solution of ordinary differential Equations using Laplace transform.

Module V: Fourier Transforms (12 hours)

Fourier Integral theorem (Proof not required)- Fourier Sine and Cosine integral representations- Fourier transforms- transforms of some elementary functions- Elementary properties of Fourier transforms- Convolution theorem (No proof)- Fourier Sine and Cosine transforms- transforms of some elementary functions- Properties of Fourier Sine and Cosine transforms.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Acquire basic knowledge of differential equations and methods of solving them.
- Model and analyze differential equations in a wide range of physical phenomena.

- Acquire the knowledge of power series expansions.
- Use tools for Laplace transforms and apply it in solution of differential equations.
- Use tools for Fourier Transforms.

TEXT BOOKS:

1. G.B.Thomas, R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced engineering mathematics, 9th Edition, John Wiley & sons 2006
3. N.P. Bali, Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications Reprint, 2008.

REFERENCE BOOKS:

1. E. A. Coddington, An introduction to ordinary differential equations, Prentice Hall 1995.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
3. Veerarajan T, Engineering Mathematics for First year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.
5. George.F.Simmons, Differential Equations, Tata Mc Graw Hill, 2001.
6. George.F.Simmons, Differential Equations with Applications and Historical notes, Tata Mc Graw Hill, 2005.
7. Ronald.N.Bracewell, Fourier Transforms and its Applications, Tata Mc Graw Hill, 2005.
8. J.Billingham, A.C.King, S.R.Otto, Differential Equations, Linear, Non-Linear, Ordinary, Partial, Cambridge University press, 2005.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

CH24 202B	ENGINEERING CHEMISTRY	2-1-2-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To enable the students to acquire knowledge in the concepts of chemistry for engineering applications.
- To familiarize the students with different application oriented topics like polymers, metal ions in biological system fuels, lubricants, batteries, energy storage devices, etc.
- To illuminate the students with the chemistry of compounds which involved in petrol, diesel, lubricants and their functions in the respective areas.
- To develop abilities and skills that is relevant to the study and practice of chemistry.
- To equip the students with the working knowledge of chemical principles, nature and transformation of materials and their applications.

SYLLABUS:

Module I: **(10 hours)**

Polymers- Polymerisation Reactions (Condensation and Addition polymerization, Free radical, Cationic, Anionic and Coordination mechanism of polymerisation), Crystallinity in polymers (Amorphous, Crystalline and Semi-crystalline Polymers), Concept of Glass Transition Temperature (Tg) in polymers.

Practical Work*:* Preparation of (i) Urea-Formaldehyde resin (ii) Phenol Formaldehyde resin

Module II: **(7 hours)**

Water- Hardness, Determination of hardness by EDTA method Softening (Lime-Soda and Ion Exchange methods), Numerical based on the above Purification of water for domestic use.

Practical Work*:* Determination of (i) Total hardness of a given water sample (ii) Chloride ion in a given water sample (iii) Dissolved oxygen present in a given water sample (iv) Percentage of available chlorine present in a given bleaching powder sample

Module III: **(12 hours)**

Lubricants- Classification (Liquid, Solid, and Semisolid) - Mechanism of lubrication of lubricants (Thick film, Thin film, and Extreme pressure) Properties of lubricants (Viscosity, Flash and Fire point, Cloud and Pour point, Aniline point, and Corrosion stability) Fuels- Classification - Calorific value and its determination using Bomb Calorimeter (Numerical problems) - Refining of Petroleum- Cracking and Reforming- Petrol Knocking and Octane number- Diesel knocking and Cetane number.

Module IV: **(10 hours)**

Electrochemistry- Electrochemical cells - Salt bridge - Helmholtz double layer -Single electrode potential - EMF of an electrochemical cell and its determination-Standard Hydrogen Electrode (SHE) - Determination of standard reduction potential using SHE - Electrochemical series and its applications. Nernst equation and its applications (Numerical problems) Storage Cells- Lead acid accumulator and Nickel-Cadmium - Fuel cells - H_2-O_2 fuel cell battery.

Module V: **(8 hours)**

Corrosion- Dry corrosion (Self protecting corrosion products- Pilling-Bed worth rule), Wet corrosion (Corrosion of iron in acidic, neutral and basic conditions) Differential aeration and Stress corrosion. Galvanic corrosion and galvanic series corrosion control by cathodic protection Inorganic coatings like Galvanizing, Tinning, Electroplating and Anodising of Aluminium.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Analyse the importance of hardness of water and the basic concept of polymers.
- Rationalize the properties of lubricants and the major fuels used in the daily life.
- Explore the basic idea of metal ions in biological system and their importance.
- Streamline the worth of electrical storage using batteries or fuel cells by learning the electrochemistry.
- List major chemical corrosion reactions and prevention methods that can be utilised in the protection of metal.

TEXT BOOKS:

1. Dr. Sunitha Rattan, A textbook of Engineering Chemistry, S. K. Kataria Publisher.
2. N. Krishnamurthy, D. Madhavan, Engineering Chemistry, PHI Learning Pvt Ltd.

REFERENCE BOOKS:

1. Seymour R.B, Introduction to Polymer Chemistry, McGraw Hill, New York.
2. Billmeyar, F.W, Textbook of Polymer Science, Wiley Interscience, New York
3. L.H. Sperling, Introduction to Physical Polymer Science, Wiley Interscience, New York
4. P.K. Goel, Water Pollution, Causes, Effects and Control, New Age International
5. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 3rd Ed., Wiley Eastern Ltd
6. P. W. Atkins, Physical Chemistry, J.D. Paula, Oxford University Press
7. V. Kumar, Introduction to Green Chemistry, Vishal Publishing House.
8. B. S. Bahl, Arun Bahl S, Advanced Organic Chemistry, Chand & Co
9. L. S. Brown, Thomas A. Holme, Chemistry for Engineering Students, Cengage Learning
10. Janice Gorzynski Smith, Organic Chemistry, McGraw-Hill Publications
11. Jain and Jain, Engineering Chemistry, Dhanpat Rai Publishers
12. P. Rath, Engineering Chemistry, Cengage Learning
13. M.J. Shultz, Engineering Chemistry, Cengage Learning, New Delhi
14. R. Mukhopadhyay, S. Datta, Engineering Chemistry, New Age International Publishers
15. S. S. Dara, S. S. Umare, A textbook of Engineering Chemistry, S. Chand Pvt Ltd

Internal Continuous Assessment (Maximum Marks-50)
50% - Tests (minimum 2)
10% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
30% - Lab Performance including Test and Record
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

BE24 204B	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	2-2-0-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To set a firm and solid foundation in Electrical and Electronics Engineering with strong analytical skills and conceptual understanding of basic laws and analysis methods in electrical and magnetic circuits.
- To get knowledge about types, specification and common values of passive components.
- To understand the working of diodes and transistors.
- To impart knowledge about basic electronic and digital systems.
- To familiarize the working of amplifiers and oscillators.

SYLLABUS:

Module I: **(10 hours)**

DC Circuits (Only Independent sources) Kirchhoff's law, ideal and practical voltage and current sources. Mesh and Nodal analysis (Super node and super Mesh excluded). Star-delta transformation (resistive networks only-derivation is not needed).
AC Fundamentals: Mathematical and graphical representation of sinusoidal voltage, concept of cycle, period, frequency, instantaneous, peak, average, R.M.S. values, peak factor and form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation.

Module II: **(12 hours)**

Single phase AC Circuits: Study of series R-L, R-C, R-L-C circuits, concept of impedance and admittance for different combinations, wave form and relevant voltage current phasor diagrams. Concept of active, reactive, apparent power.
Polyphase AC circuits: Concept of three phase supply and phase sequence. Balanced and unbalanced loads voltage current and power relations in three phase balanced star and delta loads and their phasor diagrams - numerical problems.

Module III: **(8 hours)**

Magnetic circuits: MMF, field strength, flux density and reluctance (definitions only). Comparison of electric and magnetic circuits. Energy stored in magnetic circuits, magnetic circuits with air gap - numerical problems on series magnetic circuits.
Electromagnetic induction: Faraday's laws, Lenz's laws- statically and dynamically induced EMF- self-inductance, mutual inductance and coefficient of coupling.

Module IV: **(10 hours)**

Passive components: Resistors: Different types- construction- color code- power rating and Tolerance. Capacitors: different types- construction- color code. Inductors: construction- different types- transformers-Electro mechanical components: relays and contactors.

PN junction diode- principle of operation-VI characteristics- bipolar junction transistor- PNP and NPN structures, Principle of operation, input and output characteristics of common emitter configuration (NPN only).

Module V: (12 hours)

Digital Systems: logic expressions, Boolean laws, duality, De-Morgan's law, logic functions and gates, adders and subtractors. Block diagram description of a dc power supply, half wave and full wave (including bridge) rectifiers, capacitor filter, working of simple zener voltage regulator.

Amplifiers: principle of electronic amplifiers, circuit diagram and working of common emitter amplifier- Oscillators: working principles of oscillators, concepts of feedback, circuit diagram and working of RC phase shift oscillator, Functional block diagram of operational amplifier, ideal operational amplifier, inverting and non-inverting amplifier.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Apply fundamental concepts and circuit laws to solve simple DC electric circuits.
- Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state.
- List the basic electronic components such as passive and electro mechanical components.
- Develop simple circuits using diodes and transistors.
- Analyze simple circuits on operational amplifiers and digital gates.

TEXT BOOKS:

1. Edward Hugs, Electrical & Electronic Technology, Pearson Education, 9/e.
2. Vincent Del Toro, Electrical Engineering Fundamentals, Pearson Education.
3. SK Bhattacharya, Basic Electrical & Electronics Engineering, Pearson.
4. M.S Sukhija, T.K Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University press, 2012.
5. Bell D. A., Electronic Devices and Circuits, Oxford University Press.
6. Tomasy W., Advanced Electronic Communication system, PHI Publishers.

REFERENCE BOOKS:

1. Kothari, Nagrath, Theory & problems of Basic Electrical engineering, Tata McGraw Hill.
2. JB Gupta, A course in electrical Engg. SK. Kataria & Sons.
3. BL Theraja, Electrical Technology Vol. 1.
4. K Uma Rao, Basic Electrical Engineering, Pearson.
5. Boylested R. L. and Nashelsky L., Electronic Devices and Circuit Theory, Pearson Education.
6. Frenzel L. E., Principles of Electronic Communication Systems, McGraw Hill.
7. Kennedy G. and Davis B., Electronic Communication Systems, McGraw Hill.
8. Rajendra Prasad, Fundamentals of Electronic Engineering, Cengage Learning.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

PC24 206B	PROGRAMMING FOR PROBLEM SOLVING USING C	2-1-2-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To understand the various steps in program development.
- To understand the basic concepts in C programming language.
- To understand the various concepts in arrays and user defined functions.
- To understand the basic concepts of structure and union.
- To Familiarise different file operations in C

SYLLABUS:

Module I: **(9 hours)**

Computer basics: A simple model of a computer- hardware and software, characteristics of computers, Computer generations and classification. Input/ Output Units. Computer memory: Read Only Memory, RAM and Hierarchy of memory. Processor; System Software: Operating Systems, Compiler, Interpreter, Assembler, Loader, Linker, Macro; Application Software. Computer Languages: Machine language, Assembly language, High level languages.

Module II: **(12 hours)**

Flowchart and algorithm -Overview of C- Importance of C- Basic structure of C program - Constants, Variables and Data Types- Operators and Expressions- Decision making and branching- Decision making and Looping- Programming examples

Module III: **(12 hours)**

Arrays- Declaration and Initialization of One dimensional array- Two dimensional array- Initializing Two dimensional Arrays- Character Arrays and Strings- Initializing String Variables- Reading and writing String- Putting Strings Together- Comparison of Two Strings- String handling Functions- User defined functions- Declaring, defining, and accessing functions- parameter passing methods- passing arrays to functions- Recursion- The Scope, Visibility and lifetime of Variables- Programming examples

Module IV: **(9 hours)**

Structures and Union- Defining a Structure- Declaring Structure Variables- Accessing Structure Members- Structure initialization- Arrays of Structures- Arrays within Structures- Unions- Pointers- Understanding of Pointers- Accessing the address of a variable- Declaring the pointer variables- Initializing pointer variables- Accessing a variable through its pointer- Pointers as function arguments- simple example programs.

Module V: **(10 hours)**

File Management in C- Defining and opening a file- Closing a file- Input and Output Operations on File- Dynamic Memory Allocation and Linked lists- Dynamic Memory Allocation - Allocating a block of Memory: malloc - Allocating multiple blocks of Memory: calloc- releasing the used space: Free- Altering the size of a block: realloc.

Case Study: Apply programming constructs of C language to solve the real-world problems like Temperature Conversion Tool, Simple Calculator, Gradebook Application etc.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Elucidate the basic architecture and functionalities of a computer.
- Apply programming constructs of C language to solve the real-world problem.
- Design and implement applications using arrays, strings and structures.
- Develop and implement applications in c using pointers.
- Design and develop solutions to problems using modular programming constructs using functions.

TEXT BOOKS:

1. E. Balaguruswamy, Programming in ANSI C, 3rd edition., Tata McGraw Hill, New Delhi, 2018.
2. Goel A, Computer Fundamentals, Pearson Education, India, 2010.

REFERENCE BOOKS:

1. B. Gottfried, Programming with C, 2nd edition, Tata McGraw Hill, New Delhi, 2006.
2. B. W. Kernighan, and D. M. Ritchie, The C Programming Language, 2nd edition Prentice Hall of India, New Delhi, 1988.
3. K. N. King. C Programming: A Modern Approach, 2nd edition, W. W. Norton & Company, 2008.
4. M. Meyer, R. Baber, Computers in Your Future, 3rd edition, Pearson Education India.
5. Raja Raman V, Computer basics programming in C, 6th edition, PHI Learning.
6. Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Introduction to Algorithms, 3rd ed. MIT press.

Internal Continuous Assessment (Maximum Marks-50)

40% - Test 1 (Theory)
40% - Test 2 (Internal Lab Examination)
10% - Fair Record
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

EN24 209	BIOLOGY FOR ENGINEERS	3-0-0-3

PRE-REQUISITES: Basic knowledge in the biological aspects of the human body.

COURSE OBJECTIVES:

- Analysis of physiological systems, enzyme classification and genetic principles.
- Understand various instrumentation systems for measurement and analysis of physiological parameters.
- Understand the foundational principles of proficiency in respiratory measurements and pulmonary function assessments.
- Apply knowledge of diagnostic imaging techniques.
- Evaluate the physiological impacts of electric currents and implement preventive measures to mitigate electrical hazards in healthcare.

SYLLABUS:

Module I: **(10 hours)**

Introduction to biomedical engineering - Role of biomedical engineers. Physiological systems of the human body. Circulatory systems- Pulmonary circulation- Blood group- Protiens- structure and function- RNA, DNA, Mendel's laws (principle only)

Module II: **(10 hours)**

Cardiovascular system: heart- structure of heart and major blood vessels, cardiac cycle, ECG- waveform, Einthoven triangle- Electro encephalogram (EEG): structure of brain, Wave form, stroke. Electrodes and leads- Bio electric potentials: EMG, EGG, ERG, EOG. (Basic principle and waveform only)

Module III: **(10 hours)**

Respiratory measurements: Spirometry- Basic system and applications- Pulmonary function measurements: Respiratory volumes, lung capacity, tidal volume. Blood Pressure, Ventilator, cardiac pacemaker, Dialysis, Infant incubator, Diathermy, Lithotripsy (concepts only).

Module IV: **(10 hours)**

Ultrasound scanning (application level) 3D and 4D. Angiography, Endoscopy, X-Ray, CT, MRI, Oximeter (application level). A- scan, B-scan and M -scan.

Module V: **(9 hours)**

Physiological effects of electric currents, Macro shock and Microshock. Leakage current. Sources of electrical hazards. Different methods of electric accident prevention. Safety Codes.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Serve as a foundation course for engineers in the healthcare field.
- Introduce the basic anatomy of the major systems of engineering importance in the human body.
- Study the basic physiological concepts of the systems.

- Explore the basic engineering principles related to human physiology.
- Understand the electrical safety and ability to design relevant protection systems.

TEXT BOOKS:

1. Laura lee Sherwood, Human Physiology: From Cells to Systems, Brooks/Cole, Cengage Learning.
2. Arthur C. Guyton, Textbook of Medical Physiology, Prism Books (Pvt) Ltd; W.B. Saunders Company.
3. John G Webster, Medical Instrumentation Application and Design, 5/e, Wiley.

REFERENCE BOOKS:

1. Samson Wright, Cyril A. Keele (editor), Eric Neil (editor): Applied Physiology, Oxford University Press.
2. J.B.West, Best and Taylor's Physiological Basis of Medical Practice, Williams and Wilkins, Baltimore.
3. Valerie C. Scanlon, Tina sanders, Essentials of anatomy and physiology.
4. W.F.Ganong, Review of Medical Physiology, Prentice-Hall, Connecticut. Kathleen.
5. J.W. Wilson, Ross, Wilson, Anatomy and Physiology in Health and Illness, ELBS/Churchill Livingstone.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

EN24 210	UNIVERSAL HUMAN VALUES	3-0-0-3

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence.
- Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with nature.
- To know the Holistic technologies, management models and production systems

SYLLABUS:

Module I: **(10 hours)**

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education
Understanding the need, basic guidelines, content and process for Value Education. Self-Exploration- Its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Module II: **(10 hours)**

Understanding Harmony in the Human Being - Harmony in Myself!
Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Module III: **(10 hours)**

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship
Understanding Harmony in the family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfilment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the meaning of Vishwas; Difference between intention and

competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family.

Module IV: (10 hours)

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence
Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

Module V: (12 hours)

Implications of the above Holistic Understanding of Harmony on Professional Ethics
Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: **a)** Ability to utilize the professional competence for augmenting universal human order **b)** Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, **c)** Ability to identify and develop appropriate technologies and management patterns for above production systems.
Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: **a)** At the level of individual: as socially and ecologically responsible engineers, technologists and managers **b)** At the level of society: as mutually enriching institutions and organizations.

COURSE OUTCOMES:
At the end of the course the students will be able to

- Find that technical education without study of human values can generate more problems than solutions.
- See that they can enlist their desires and the desires are not vague.
- See that all physical facilities they use are required for a limited time in a limited quantity.
- Differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them.
- Present sustainable solutions to the problems in society and nature, draw roadmaps to achieve them.

TEXT BOOKS:

1. B L Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, Science and Humanism, Commonwealth Publishers, 1990.
3. Sussan George, How the Other Half Dies, Penguin Press. Reprinted 1991.

4. Subhas Palekar, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati, 2000.
5. A Nagraj, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak, 1998.
6. A.N. Tripathy, Human Values, New Age International Publishers, 2003.

REFERENCE BOOKS:

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010.
2. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

EN24 211	ENVIRONMENTAL SCIENCE	2-0-0-0

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To impart basic knowledge about the environment and its allied problems.
- To understand the problems of pollution, deforestation, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues at local and global levels.
- To create awareness among the students to address these issues and conserve the environment in a better way.
- To make students aware of the basic structure and functions of ecosystem.
- To explain and discuss the distribution of different natural resources and their sustainable management.

SYLLABUS:

Module I: **(7 hours)**

Environment and Environmental Science- Definition, concept, components, and importance- Ecosystem and Ecology- Structure and Function of Ecosystem, Food chain, food web and ecological pyramids.

Module II: **(7 hours)**

Environmental Pollution - Definition, causes, effects and control measures- a. Air pollution b. Water pollution (thermal and marine pollution) c. Land pollution d. Radiation pollution and Nuclear hazard. e. Noise pollution. Solid waste management- Causes, effects and control measures- Global warming and climate change Ozone depletion- Acid rain- Causes, effects and control measures.

Module III: **(7 hours)**

Biodiversity - Definition, concept, levels, and biodiversity values- Biodiversity of India, India as a diversity nation and Hotspot of biodiversity- Threats to Biodiversity (Habitat loss, poaching of wildlife and man-wildlife conflict).

Module IV: **(7 hours)**

Natural Resources and their Conservation- Forest Resources- Uses and overexploitation of forests and consequences of deforestation- Water Resources- Use and consequences of over-utilization, concept of rainwater harvesting and watershed management, water conflicts. Food Resources- Sources of food, food problems- Impacts of modern agriculture on the environment.

Module V: **(7 hours)**

Environmental Technology- cleantech, STEM, BAT, green technologies, environmental sustainability, Environmental projects.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Develop concepts and methods from surroundings and their application in environmental problem-solving.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- Identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
- Analyse an industrial activity and identify the environmental problems.

TEXT BOOKS:

1. Daniels, Krishnaswamy, Environmental studies, Wiley India Pvt Ltd, 2009.
2. Raman Sivakumar, Introduction to environmental science and engineering, 2nd ed, Tata McGraw Hill, 2010.
3. Anindita Basak, Environmental Studies, Pearson Education, 2009.
4. Suresh K.D, Environmental Engineering and Management, Katson Books, 2007.
5. Benny Joseph, Environmental studies, 2nd ed, McGraw Hill, 2009.

REFERENCE BOOKS:

1. Raghavan Nambiar K, Textbook of Environmental Studies, Scitech Publishers (India) Pvt. Ltd.
2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009.
3. P N Palanisamy, P Manikandan, A Geetha, Manjula Rani, Environmental Science, Pearson Education, 2012.
4. D.L. Manjunath, Environmental Studies, Pearson Education, 2011.

Internal Continuous Assessment (Maximum Marks-100)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

BE24 212B(P)	ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP	0-0-4-2

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To learn how to use and maintain electrical tools and equipment.
- To develop skills in electrical safety practices and procedures.
- To impart a basic knowledge of electrical circuits, wiring and systems
- Identification of active and passive components.
- Build electronic circuits on breadboard and solder electronic circuits on PCB.

SYLLABUS:

List of experiments
(Minimum 10 experiments out of 12)

1. Familiarization of general symbols used in electrical circuits.
2. Precautions against and cure from electric shock.
3. Wiring practice of a circuit to control two lamps by two SPST switches.
4. Wiring practice of a circuit to control one lamp by two SPDT switches.
5. Wiring practice of a circuit to control one fluorescent lamp and one three pin plug socket.
6. Wiring practice of a main switch board consisting of ICDP switch, DB, MCB and ELCB.
7. Familiarization/identification of electronic components.
8. Familiarization/application of instruments and equipment: multimeter, power supply, CRO, function generator.
9. Assembling electronic circuit on general purpose bread board: Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener regulator.
10. Introduction to soldering practice: study of soldering components, solders, tools, heat sink.
11. PCB assembly and testing of full wave rectifier circuit diagram.
12. Familiarization of setting up of a PA system with different microphones, loud speakers, mixer etc.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Familiarize with the important electrical components and their working.
- Make use of various testing instruments and commonly used tools.
- Get an idea of electrical protective devices.
- Practice simple electrical wirings and installations.
- Build electronic circuits on breadboard.
- Solder electronic circuits on PCB.
- Identify various subsystems of electronic systems like PA Systems.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and viva voice
30% - Tests
10% - Attendance and Regularity in the lab

Semester End Examination (Maximum Marks-100)

50% - Procedure, conducting experiment and performance
40% - Viva Voce
10% - Fair record

EN24 301	ENGINEERING MATHEMATICS III	3-1-0-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To provide a quick overview of the concepts and results in complex function that may be useful in engineering.
- To introduce the concepts and results in complex differentiation and integration that may be useful in engineering.
- To introduce the concepts of linear algebra.
- To introduce the concept of partial differential equations.
- To formulate physical problems using partial differential equations.

SYLLABUS:

Module I: Functions of a Complex Variable I **(10 hours)**

Functions of a Complex Variable- Limit- Continuity- Derivative of a Complex function- Analytic functions - Cauchy-Riemann Equations - Laplace equation- Harmonic Functions- Conformal Mapping- Examples: e^z, sin z, cosh z, $(z+\frac{1}{z})$ - Mobius Transformation.

Module II: Functions of a Complex Variable II **(10 hours)**

Definition of Line integral in the complex plane- Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted)- Independence of path- Cauchy's integral formula- Derivatives of analytic functions (No proof)- Taylor series (No proof)- Laurent series (No proof)- Singularities- Zeros- Poles- Residues- Evaluation of residues- Cauchy's residue theorem.

Module III: Linear Algebra **(12 hours)**

Vector spaces- Definition, Examples- Subspaces- Linear Span- Linear Independence- Linear Dependence. Basis- Dimension. Orthogonal and Orthonormal Sets- Orthogonal Basis- Orthonormal Basis, Gram-Schmidt Orthogonalisation process. Inner product spaces- Definition, Examples- Inequalities- Schwartz, Triangle (No proof).

Module IV: Partial Differential Equations **(10 hours)**

Introduction- Solutions of equations of the form F(p,q) =0, F(x,p,q) =0, F(z,p,q) =0, $F_1(x,p) = F_2(y,q)$, Clairaut's form- z = px + qy + F(p,q), Lagrange's form - Pp + Qq =R. - Classification of Linear PDE's.

Module V: Applications of Partial Differential Equations **(10 hours)**

Derivation of one dimensional wave equation- solution of one dimensional wave equation- Derivation of one dimensional heat equation- solution of one dimensional heat equation.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Analyze given complex function is analytic and find its series development.
- Describe the basic properties of complex integration.

- Develop the essential tool of linear algebra in a comprehensive manner.
- Use mathematical tools for the solution of Partial differential equations that models physical processes**.**
- Model and analyze partial differential equations in a wide range of physical phenomena which has got applications across all branches of engineering.

TEXT BOOK:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. N.P. Bali, Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications Reprint, 2008.

REFERENCE BOOKS:

1. G.B. Thomas, R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson Reprint, 2002
2. Erwin Kreyszig, Advanced engineering mathematics, 9th Edition, John Wiley & sons 2006.
3. R.D.Sharma, Rittu Jain, Theory and Problems of Linear Algebra, Dreamtech press, 2019.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

EN24 302	ENGINEERING MECHANICS	3-1-0-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To acquaint with the general approach of solving engineering problems.
- To illustrate the application of the theory learned in Mechanics in practical engineering problems.
- To lay clear fundamentals to core Engineering Subjects.
- To develop analytical skills to formulate and solve engineering problems.
- To understand the concept of motion of particles and rigid bodies.

SYLLABUS:

Module I: **(12 hours)**

Introduction to engineering mechanics - units - dimensions - vector and scalar quantities - laws of mechanics - elements of vector algebra - equivalent force systems - resultant of a force system - simplest resultant of special force systems - distributed force systems. Equilibrium of concurrent forces in a plane - free body diagrams - free bodies involving interior sections- equilibrium of forces in a plane - static indeterminacy.

Module II: **(10 hours)**

Friction- laws of friction- coefficient of friction- cone of friction- angle of friction- angle of repose- wedge friction- ladder Friction- simple contact friction problems. Introduction to structural mechanics- trusses- analysis of simple trusses- method of joints- method of sections.

Module III: **(10 hours)**

First moment and centroid- centroid of wires- centroid of areas theorems of Pappus-Guldinus- problems on centroid- centroid of composite areas.
Moment of inertia of a rigid body and lamina (derivation of MI for cylinder, rod and sphere)- second moment of plane and composite areas- parallel and perpendicular axis theorems- polar moment of inertia of area- product of inertia and principal axis (conceptual level treatment only).

Module IV: **(10 hours)**

Dynamics Rectilinear translation- Combined motion of rotation and translation- Concept of instantaneous center- Motion of connecting rod of piston and crank of a reciprocating pump- Newton's second law- motion of connected bodies- D'Alembert's Principle- motion of connected bodies (Problems on motion of lift only).

Module V: **(10 hours)**

Mechanical vibrations- Free and forced vibration- Degree of freedom- Simple harmonic motion- Spring-mass model- Period- Stiffness- Frequency- Simple numerical problems of single degree of freedom.

COURSE OUTCOMES:

At the end of the course students will be able to

- Gain knowledge on basic concepts of Engineering Mechanics.
- Apply the theory of mechanics on a practical level.
- Get an idea on centroid, moment of inertia and mass moment of inertia of composite structures.
- Relate kinematics with kinetics equations in simple practical problems.
- Get knowledge on vibrations during motion.

TEXT BOOKS:

1. Shames I. H, Engineering Mechanics - Statics and Dynamics, Pearson Prentice, 2005.
2. Timoshenko S, Young D. H, Engineering Mechanics, McGraw Hill, 2017.

REFERENCE BOOKS:

1. Benjamin J., Engineering Mechanics, Pentex Book Publishers and Distributors, 2022.
2. Bhavikatti S. S., Engineering Mechanics, New Age International Publishers, 2021.
3. Hibbeler R. C., Engineering Mechanics: Statics and Dynamics. Pearson Prentice Hall, 2017.
4. Kumar D.S., Engineering Mechanics: Statics and Dynamics, S.K. Kataria & Sons, 2013.
5. Kumar K. L., Engineering Mechanics, Tata McGraw Hill Publishing Company Ltd, 2017.
6. Rajasekaran S, Sankarasubramanian G, Engineering Mechanics, Vikas Publishing House Private Limited, 2018.
7. Tayal A. K., Engineering Mechanics- Statics and Dynamics, Umesh Publications, 2016.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ME24 303	APPLIED THERMODYNAMICS	3-1-0-4

PRE-REQUISITES: Basics of Mechanical Engineering

COURSE OBJECTIVES:

- To learn the principles of work and energy.
- To acquire knowledge about the fundamentals of thermodynamic laws, concepts and principles.
- To understand the principles of various cycles and to apply the thermodynamic concepts in various applications like IC engines and Air conditioning systems
- To understand, model and appreciate concept of dynamics involved in thermal engineering transformations.
- To prepare them to carry out experimental investigation and analysis.

SYLLABUS:

Module I: **(9 hours)**

Basic concepts and definitions- Macroscopic and microscopic approach, Continuum concept, system and control volume, properties, processes and cycles, Quasi-static process, homogeneous and heterogeneous systems. Thermodynamic equilibrium, Zeroth law of thermodynamics- measurement of temperature, Temperature scales, Concept of absolute temperature scale.

Module II: **(9 hours)**

Different forms of energy, work and heat, different types of work transfer, pdV work, free expansion, First law of thermodynamics applied to closed systems executing processes and cycles- Energy transfer by mass- First law of thermodynamics applied to steady and unsteady flow processes- Steady flow engineering devices- Internal energy, enthalpy and specific heats.

Module III: **(12 hours)**

Second law of thermodynamics Thermal energy reservoirs and heat engines- Definitions of thermal efficiency and COP- refrigerators and heat pumps- Kelvin-Planck and Clausius statements- equivalence of the two statements- Carnot cycle and Carnot principles- Carnot heat engine- Definition of entropy- Clausius inequality- Entropy change of pure substances- Illustration of processes in T-S coordinates- T-ds relations- Available energy, Law of degradation of energy- Availability, and irreversibility, Gibb's and Helmholtz function.

Module IV: **(11 hours)**

Pure Substances, p-v and p-T, T-v diagram of pure substance, p-v-T surface, Saturation pressure and Temperature, T-s and h-s diagrams or Mollier Charts, Dryness Fraction, steam tables. The ideal Gas Equation, Characteristic and Universal Gas constants, Deviations from ideal Gas Model: Equation of state of real substances, Vander Waals Equation of State, Virial Expansion.

Module V: **(11 hours)**

Dalton’s Law of partial pressure, Amagat’s Laws of additive volumes, Gibbs-Dalton’s law Equivalent Gas constant and Molecular Weight, Properties of gas mixtures. General

Thermodynamic Relations- Combined First and Second law equations- Helmholtz and Gibb's functions- Maxwell's Relations, Tds Equations. The Clapeyron Equation, equations for internal energy, enthalpy and entropy, specific heats, Throttling process, Joule Thomson Coefficient, inversion curve.

COURSE OUTCOMES:

At the end of the course students will be able to

- Understand the laws of thermodynamics and their significance
- Apply the principles of thermodynamics for the analysis of thermal systems
- Apply the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon.
- Identify and formulate power production based on the fundamental's laws of thermal engineering.
- Investigate the effectiveness of energy conversion process in mechanical power generation for the benefit of mankind.

TEXT BOOKS:

1. P.K. Nag, Engineering Thermodynamics, 4th Edition, McGraw Hill, 2013.
2. E. Rathakrishnan, Fundamentals of Engineering Thermodynamics, PHI, 2005.
3. M.A Achuthan, Engineering Thermodynamics, PHI, 2004.
4. Holman J.P, Thermodynamics, McGraw Hill, 2004.

REFERENCE BOOKS:

1. Sonntag, Van Wylen, Fundamentals of Thermodynamics, 6th ed, John Wiley & Sons
2. Yunus Cengel, Thermodynamics an Engineering Approach, 4th Edition, McGraw Hill
3. Y V C Rao, An Introduction to Thermodynamics, Universities Press, 2003.
4. John Francis Lee, Francis Weston Sears, A Text book on thermodynamics
5. Spalding, Cole, Engineering thermodynamics, ELBS, 1976.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

ME24 304	FLUID MECHANICS	3-1-0-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To study the mechanics of fluid motion
- To develop understanding about basic laws and equations used for analysis of static and dynamic fluids
- To develop understanding about basic flow measuring instruments and their working principle.
- To understand about pipe flow and its characteristics.
- To familiarize students with the relevance of fluid mechanics to many engineering systems

SYLLABUS:

Module I: **(10 hours)**

Fluids and continuum, Physical properties of fluids, Newton's law of viscosity. Ideal and real fluids, Newtonian and non - Newtonian fluids. Fluid Statics-Pressure -density-height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, measurement of pressure.

Module II: **(10 hours)**

Eulerian and Lagrangian approaches, classification of fluid flow, 1- D, 2-D and 3-D flow, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, stream lines, path lines, streak lines, stream tubes, Discharge-continuity equation, velocity and acceleration in fluid, circulation and vorticity, stream function and potential function.

Module III: **(11 hours)**

Dynamic of fluid flow: energies in flowing fluid-pressure head, dynamic head, static head, total head- Euler's equation of motion and integration of Euler's equation of motion along a streamline-Bernoulli's equation and its limitations-applications of Bernoulli's equation venturi meter, orifice meter, pitot tube, orifices and mouthpieces, notches and weirs. Momentum Principle- Steady flow momentum equation-momentum and energy correction factors.

Module IV: **(11 hours)**

Pipe flow: Viscous flow - Shear stress-Reynolds experiments-laminar and turbulent flow, Reynolds number- velocity and shear stress distribution in a pipe-head loss due to friction, Hagen Poiseulle's Equation-Turbulent flow throw pipe-Darcy Weisbach equation-chezy's equation, Major and minor losses of flow in pipes-hydraulic gradient line and total energy line flow through long pipe-pipes in series and parallel-equivalent pipe-water hammer.

Module V: **(10 hours)**

Boundary layer-boundary layer flow theory- boundary layer over flat plate-boundary layer thickness-displacement, momentum and energy thickness-laminar and turbulent boundary layers- laminar sub layer-velocity profile-Von Karman momentum integral equations for the boundary layers-drag and lift- boundary layer separation, methods of controlling.

COURSE OUTCOMES:

At the end of the course students will be able to

- Familiarize with various fluid properties and to calculate pressure variation and forces in static fluids.
- Calculate pressure variations in accelerating fluids using Euler's and Bernoulli's equations.
- Become conversant with the concepts of flow measurements and flow through pipes.
- Apply the momentum and energy equations to fluid flow problems.
- Evaluate head loss in pipes and conduits.

TEXT BOOKS:

1. Balachandran P, Engineering fluid mechanics, PHI, 2010.
2. S. K. Som, G Biswas, Fluid Mechanics, Tata McGraw Hill, 2017.
3. D.S. Kumar, Fluid Mechanics & Fluid Power Engg, S Kataria & Sons, 2018.
4. R. K. Bansal, Fluid Mechanics & Hydraulic Machines, Laxmi Publications, 2019.
5. R.K. Rajput, Fluid Mechanics, S Chand & Co, 2016.

REFERENCE BOOKS:

1. Cengel, Fluid Mechanics, McGraw Hill Education India, 2019.
2. Douglas, Fluid Mechanics, Pearson Education, 2019.
3. White F.M., Fluid Mechanics, Tata McGraw Hill, 2022.
4. Fox, Mc Donald, Introduction to Fluid Mechanics, John Wiley, 2021.
5. F.M. Streeter, Fluid Mechanics, Tata McGraw Hill, 2017.

STEAM TABLES/DATA BOOK:

R.S.Khurmi, Steam table with Mollier chart, S.Chand, 2008

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% -Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question

ME24 305	ELECTRICAL TECHNOLOGY	3-1-0-3

PRE-REQUISITES: Basics of Electrical Engineering

COURSE OBJECTIVES

- To understand the basic principles of operation of rotating electric machines, their classification and basic efficiency and performance characteristics.
- To know the basic principle of single phase transformers and its performance.
- To understand the basic principle, characteristics of alternators and synchronous motors
- To study about 3-phase induction motors and starting methods
- To study an overview of power electronic devices and electric drives

SYLLABUS:

Module I: **(11 hours)**

DC machines: Basic principle of operation of DC Generator, Construction, EMF Equation, Types of Generators, Armature Reaction and Commutation (Basics only), Characteristics of DC Generator, losses and efficiency, Applications of DC Generator.
DC Motor: Working Principle, Torque equation, Characteristics of DC Motors, Starters, Brake Test, Swinburne´s test, Application of DC motor**.**

Module II: **(11 hours)**

Transformers: Working principle of Transformer, Ideal Transformer, Construction of Single-Phase Transformer, EMF equation, Turns Ratio, Equivalent Circuit, Vector Diagram, Impedance Transformation, Transformer Losses, Efficiency, Voltage Regulation, Open Circuit and Short Circuit Test, Load test.
Auto transformer: Construction and Working, Saving of Copper, Advantages, All day efficiency, Distribution and Power Transformer, Applications

Module III: **(9 hours)**

Review of Alternators: EMF equation, Distribution and chording factor, Characteristics, losses and efficiency, Armature Reaction, Voltage Regulation (emf method only), applications. Synchronous motor-principles of operation, over excited and under excited, Starting, applications, synchronous capacitor.

Module IV: **(9 hours)**

Review of 3-phase induction motor: Slip, rotor frequency, equivalent circuit, phasor diagram, torque equation, Torque- Slip Characteristics, losses and efficiency, Starting of 3-Phase Induction Motors: Direct-On-Line, Autotransformer, Star Delta and Rotor Resistance Starting.

Module V: **(12 hours)**

Power semiconductor devices: General overview about SCR, Power MOSFET and IGBT, Static Characteristics of SCR.
Electrical Drives: Advantages of Electric Drives, parts of electrical drives, fundamental Torque Equation, Four Quadrant Operation, Components of Load Torque- Friction, Windage and Load torques.

Speed Control of Motors: Armature Voltage Control of a DC Motor, 3-Phase Induction Motor Drives Stator Voltage Control (concept only), Stator Voltage and Frequency Control (Block Diagram Approach).

COURSE OUTCOMES

At the end of the course students will be able to

- Study the concept of different types, constructional details, operational principles, and performance characteristics of DC motors and DC generators.
- Explain the construction and working of transformers, transformer losses, current transformer, and potential transformers.
- Explain the constructional details, operational principles, performance characteristics, speed control of synchronous motors and alternators.
- Explain the characteristics and working of 3-phase induction motors.
- Know about various power semiconductor devices and drives.

TEXT BOOKS:

1. Ashfaq Hussain, Electrical Machines, Dhanpat Rai & Co., 3rd Ed, 2016.
2. P.S. Bimbhra, Power Electronics, Khanna Publishers, 1990.
3. Dubey G.K., Fundamentals of Electrical Drives, Narosa Publishing House, 2010

REFERENCE BOOKS:

1. Nagrath, I. J, Kothari D.P, Electrical Machines, Tata McGraw Hill Publishing Co. Limited, 1997.
2. Bimbra, F. S., Electrical Machines, 7th Edition, Khanna publishers, 2007.
3. Gupta B.R, Vandana Singhal, Fundamentals of Electric machines, D.K Publishers, 2000.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Total Marks- 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question

EN24 306	LIFE SKILLS & PROFESSIONAL ETHICS	3-1-0-0

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To develop communication competence in prospective engineers.
- To enable them to convey thoughts and ideas with clarity and focus.
- To equip them to face group discussion, debate and to inculcate critical thinking process.
- To prepare them on problem solving skills and to understand team dynamics and effectiveness.
- To learn leadership qualities and practice them.

SYLLABUS:

Module I: **(14 hours)**

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self- awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

Life skills for professionals: positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ and SQ.

Group Discussion: Differences between group discussion and debate; Ensuring success in group discussions.

Presentation Skills: Oral presentation and public speaking skills; business presentations, Technology-based Communication: Netiquettes: effective e-mail messages; power-point presentation; enhancing editing skills using computer software.

Module II: **(8 hours)**

Need for Creativity in the 21st century: Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity

Critical thinking Vs Creative thinking: Functions of Left Brain and Right brain, Convergent and Divergent Thinking, Critical reading and Multiple Intelligence.

Steps in problem solving, Problem Solving Techniques: Problem Solving through Six Thinking Hats, Mind Mapping, Forced connections.

Problem Solving strategies, Analytical Thinking and quantitative reasoning expressed in written form, Numeric, symbolic, and graphic reasoning, solving application problems.

Module III: **(10 hours)**

Introduction to Groups and Teams: Team Composition, Managing Team Performance, Importance of Group, Stages of Group, Group Cycle, Group Problem Solving, Achieving Group Consensus, Group Dynamics techniques, Group Vs Team, Team Dynamics, Managing Team Performance and Managing Conflict in Teams. Working Together in Teams, Team Decision-Making, Team Culture and Power, Team Leader Development.

Module IV: **(10 hours)**

Morals, Values and Ethics, Integrity: Work Ethics, Service Learning, Civic Virtue, Respect for Others, Living Peacefully. Senses of 'Engineering Ethics', variety of moral issues, Types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, Consensus and controversy, Models of Professional Roles, Theories about right action, Self-interest, customs and religion, application of ethical theories. Engineering as experimentation, engineers as responsible experimenters, Codes of ethics.

Environmental ethics, computer ethics, Weapons development, engineers as managers, consulting engineers, engineers as expert witnesses and advisors, moral leadership, sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

Module V: **(10 hours)**

Introduction, a framework for considering leadership: entrepreneurial and moral leadership, vision, people selection and development, cultural dimensions of leadership, Growing as a leader, turn around leadership, gaining control, trust, managing diverse stakeholders, crisis management, Implications of national culture and multicultural leadership, Types of Leadership, Leadership Traits.

Leadership Styles, VUCA Leadership, DART Leadership, Transactional Vs Transformational Leaders, Leadership Grid, Effective Leaders, making of a Leader, Formulate Leadership

COURSE OUTCOMES:

At the end of the course, the students will be able to

- Define and Identify different life skills required in personal and professional life
- Make effective presentations, face group discussion and debate.
- Critically think about a particular problem and solve them.
- Work in Group and Teams
- Become an effective leader.

TEXT BOOK:

Life Skills for Engineers, Complied by ICT Academy of Kerala, McGraw Hill Education (India) Private Ltd., 2016

REFERENCE BOOKS:

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2. Barun K. Mitra, "Personality Development & Soft Skills", 1st Ed, Oxford Publishers, 2011.
3. Kalyana, Soft Skill for Managers, 1st Edition, Wiley Publishing Ltd., 2015.
4. Larry James, The First Book of Life Skills, 1st Edition; Embassy Books, 2016.
5. Shalini Verma, Development of Life Skills and Professional Practice, 1st Edition; Sultan Chand (G/L) & Company, 2014.
6. John C. Maxwell, The 5 Levels of Leadership, Centre Street, A division of Hachette Book Group Inc., 2014.
7. Remesh S., Vishnu R.G., Life Skills for Engineers, Ridhima Publications, 1st Edition, 2016.

Internal Continuous Assessment (Maximum Marks-100)

50% - Group Discussion
50% - Presentation Skills

ME24 307 (P)	COMPUTER ASSISTED MACHINE DRAWING	0-0-3-1

PRE-REQUISITES: Engineering Graphics

COURSE OBJECTIVES:

- To impart the fundamental concepts of machine drawing
- To produce orthographic drawing of different machine parts.
- To develop skill to produce assembly drawings.
- To develop skill to produce detailed drawings of machines parts from assembly drawing.
- To develop skill to produce drawings by using any standard CAD software.

SYLLABUS:

Module I: (1 Printout, 2 Drawing sheets) (9 hours)

Preparation of sketch and working drawing for:

a) Joints: Sleeve and cotter joints, knuckle joints, Socket and spigot joints, Flanged hydraulic joints, Lap and butt joint, Zigzag and chain structure
b) Couplings and pulleys: Solid and split muff couplings, Universal coupling, Pulleys: Flat pulleys, V-pulleys, Stepped cone pulleys.

Module II: (1 Printout, 2 Drawing sheets) (9 hours)

Preparation of sketch and working drawing for:

a) Tolerances and Fits - Limits and tolerances of machine parts - Hole system and shaft system of tolerances - Designation of fundamental deviation - Types of fits and their selection - Indication of dimensional tolerances and fits on simple machine parts - Geometrical tolerances- Recommended symbols - Indication of geometrical tolerances on simple machine parts - Surface roughness- Indication of surface finish on drawings - Preparation of shop floor drawings of simple machine parts.
b) Bearings - Solid journal bearings, Plummer block and footstep bearings.

Module III: (3 Printout, 6 Drawing sheets) (15 hours)

Preparation of sketch and assembly drawing for: Stuffing boxes, Plummer block, Eccentrics, Screws jacks, Machine Vices, Lathe Tailstock, Rams bottom safety valve.

Note:

- Drawing practical classes have to be conducted by using any standard CAD software and using drawing instruments. Semester End examination (3 Hours) shall be conducted by using drawing instruments only.
- All drawing exercises mentioned above are for class work. Additional exercises where even necessary may be given as home assignments.

COURSE OUTCOMES:

At the end of the course students will be able to

- Acquire the knowledge of various standards and specifications about standard machine components.
- Make drawings of assemblies with the help of part drawings given.
- Select, configure and synthesize mechanical components into assemblies.
- Understand isometric projections of machine elements.
- Model components of their choice using CAD software.

TEXT BOOK:

N.D. Bhatt and Panchal, Machine Drawing, Charator Publishing House, 2013.

REFERENCE BOOKS:

1. K.L.Narayana, P.Kannaiah, K. VenkataReddy, Machine Drawing, New Age Publishers, 2009.
2. GautamPohit, Gautam Ghosh, Machine Drawing with AUTO CAD, Pearson Education, NewDelhi, 1st Ed, 2014.
3. K.C. John, Machine Drawing, Jet Publications, Thrissur, 2009.
4. N.D.Junnarkar, Machine Drawing, Pearson Education, New Delhi, 2007.
5. P.I.Varghese, Machine Drawing, VIP Publishers, Thrissur, 2010.

Internal Continuous Assessment (Maximum Marks-50)
20% - Printouts
40% - Drawing sheets
30% - Tests
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)
70% - Test
20% - Viva voce
10% - Final sheet submission

ME24 308 (P)	ELECTRICAL TECHNOLOGY LAB	0-0-3-1

PRE-REQUISITES: Electrical Technology

COURSE OBJECTIVES:

- To obtain the performance characteristics of DC motors and starting methods
- To obtain the performance characteristics of AC motors
- To familiarize AC and DC generators
- To know about calibration methods
- To obtain the transformer efficiency losses and regulation

SYLLABUS:

List of Experiments

1. Calibration of single phase energy meter (Induction and Static type) by direct loading
2. Load test on DC shunt generator
   a) Plot external characteristics
   b) Deduce internal characteristics
3. Brake test on 3-phase squirrel cage induction motor
   a) Plot the performance characteristics
4. Brake test on DC series motor
   a) Plot the performance characteristics
5. Brake test on DC shunt motor
   a) Plot the performance characteristics
6. Determination of V-I characteristics of linear resistance and incandescent lamp
7. No-load and blocked rotor tests on slip ring induction motor
   a) Determine equivalent circuit parameters
   b) Predetermine the torque, line current and efficiency from equivalent circuit corresponding to a specified slip.
8. Measurement of L, M and K of i) transformer windings and ii) air core coil.
9. OC & SC tests on 3-phase alternator
   a) Predetermine the voltage regulation at various loads and different power factors by EMF method.
10. Load test on single phase transformer
    a) Determine efficiency and regulation at various loads and unity power factor.
11. OC and SC tests on single phase transformer
    a) Determine equivalent circuit parameters
    b) Predetermine efficiency and regulation at various loads and different power factors.

12. Open circuit characteristics of dc shunt generator

a) Plot OCC of rated speed
b) Predetermine OCC for other speeds
c) Determine critical field resistance for a specified speed
d) Determine critical speed for a specified shunt field resistance

COURSE OUTCOMES:

At the end of the course the students will be able to

- Obtain the performance characteristics of dc and ac machines.
- Measure power and energy in single phase circuit.
- Measurement of power and power factor single phase and three phase circuits.
- To know the working of generators
- To know about working of transformer

REFERENCE BOOK:

D P Kothari, B S Umre, Laboratory Manual for Electrical Machines, Wiley Publications, 2nd Ed, 2020.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and Viva voce
30% - Tests
10% - Regularity in the lab

Semester End Examination (Maximum Marks-100)

70% - Procedure, conducting experiment, result, tabulation, and inference
20% - Viva voce
10% - Fair record

ME24 401	HEAT & MASS TRANSFER	3-1-0-4

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To introduce the various modes of heat transfer and to develop methodologies for solving a wide variety of practical heat transfer problems.
- To understand the mechanisms of heat transfer under steady and transient conditions.
- To understand the concepts of heat transfer through extended surfaces.
- To provide useful information concerning the performance and design of simple heat transfer systems.
- To introduce mass transfer.

SYLLABUS:

Module I: Conduction heat transfer (12 hours)

Conduction: Introduction- modes of heat transfer- conduction- general heat conduction equation in Cartesian, cylindrical and spherical coordinates- one dimensional steady state conduction with and without heat generation- critical thickness of insulation- extended surface heat transfer- fin performance- effect of variable thermal conductivity. Unsteady state conduction in one dimension- lumped heat capacity system- semi-infinite solid with sudden and periodic change in surface temperature.

Module II: Convection heat transfer (14 hours)

Convection: Newton's law- concept of boundary layer- dimensionless number- boundary layer equations- flat plate heat transfer solutions by integral method- flow Reynolds analogy- empirical relations in forced convection- internal flow- boundary conditions- laminar and turbulent flow- heat transfer coefficients- empirical correlations. Natural convection- heat transfer from vertical plate by integral method- empirical relation in free convection. Condensation and boiling heat transfer- film and drop wise condensation- film boiling and pool boiling- boiling curve- empirical relations for heat transfer with change of phase.

Module III: Radiation heat transfer (10 hours)

Radiation: Fundamentals of radiation- radiation spectrum- thermal radiation- concept of black body and grey body- monochromatic and total emissive power- absorptivity, reflectivity and transmissivity- laws of radiation- radiation between two surfaces- geometrical factors for simple configuration- radiation shields- electrical network method of solving problems.

Module IV: Heat exchangers (8 hours)

Heat exchangers: Classification- log mean temperature difference- overall heat transfer coefficient- fouling and scaling of heat exchangers- LMTD and NTU method of performance evaluation of heat exchangers.

Module V: Mass Transfer **(8 hours)**

Introduction to mass transfer- Molecular diffusion in fluids- Steady state molecular diffusion in fluids under stagnant and laminar flow conditions - Fick's law of diffusion- Types of solid diffusion- mass transfer coefficients in laminar and turbulent flows- Introduction to mass transfer coefficient Equimolar counter-diffusion- Correlation for convective mass transfer coefficient- Correlation of mass transfer coefficients for single cylinder- Theories of mass transfer- Overall mass transfer coefficients.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Analyze empirical situation of steady and transient conduction heat transfer
- Evaluate heat transfer coefficients in natural and forced convection in and out of control areas.
- Access performance of various heat exchangers.
- Solve numerical problems related to conduction and radiation heat transfer.
- Design heat transfer systems such as heat exchangers, fins, radiation shields etc.

TEXT BOOKS:

1. P. K. Nag, Heat and Mass Transfer, Tata McGraw Hill, 3rd Ed, 2011.
2. Sachedeva, Heat and Mass Transfer, New Age International, 5th Ed, 2017.
3. D. S. Kumar, Heat and Mass Transfer, S.K. Kataria & Sons, 2013.
4. R.K.Rajput. Heat and mass transfer, S Chand & Co., 2015.

REFERENCE BOOKS:

1. Younus A Cengel, Heat Transfer, Tata McGraw Hill, 2010.
2. F. P. Incropera, Fundamentals of Heat and Mass Transfer, John Wiley, 7^{th} Ed, 2011.
3. Holman, Heat and Mass Transfer, McGraw Hill, 10^{th} Ed, 2009.

DATABOOKS PERMITTED FOR REFERENCE IN THE FINAL EXAMINATION:

Heat and Mass Transfer data book: C.P. Kothandaraman, S. Subramanya, New age International publishers, 2014

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ME24 402	HYDRAULIC MACHINERY	3-1-0-4

PRE-REQUISITES: Basics of Mechanical Engineering

COURSE OBJECTIVES:

- Calculate forces and work done by a jet on fixed or moving plate and curved plates
- To study the operation, performance and characteristics of different types of hydraulic machines.
- Familiarize with working centrifugal pumps and its performance curves.
- Analyze the working of air compressors and Select the suitable one based on application.
- To study about Positive displacement pumps and air vessel.

SYLLABUS:

Module I: (10 hours)

Dynamic Action of Fluid*:* Impulse Momentum equation- applications- impact of jet- flow of an incompressible fluid over fixed and moving vanes- workdone and efficiency- reaction principle- propulsion of ships.
Non dimensional parameters in fluid mechanics and fluid machinery- principle of similitude, geometric, kinematic and dynamic similarity- model studies. Non dimensional numbers (Reynold's number, Froude's number, Euler's number, Weber's number and Mach's number)

Module II: (10 hours)

Hydraulic turbines*:* Classification- impulse and reaction turbines- Euler`s turbine equation. Velocity triangles- Pelton wheel, Francis turbine Kaplan turbine- construction features and performance characteristics- theory of draft tube- speed regulation of turbines- run away speed- selection, type and speed of turbines.

Module III: (11 hours)

Pumping machinery*:* General classification- Rotodynamic pumps- construction features, classification of impellers, impeller shapes- types of casings- working of centrifugal pumps, priming, Euler`s head equation- velocity triangles- losses, head and efficiencies- performance pump characteristics: main, operating characteristics curves- selection of pumps from performance curves- NPSH required- NPSH available- multistage pumps- pumps in parallel and series operation- propeller pumps.

Module IV: (11 hours)

Compressors: classification of compressors, reciprocating compressor- single stage compressor, equation for work with and without clearance volume, efficiencies, multistage compressor, intercooler, free air delivered (FAD).
Centrifugal compressor-working, velocity diagram, work done, power required, width of blades of impeller and diffuser, isentropic efficiency, slip factor and pressure coefficient, surging and chocking. Axial flow compressors: working, velocity diagram, degree of reaction, performance.

Module V: **(10 hours)**

Positive displacement pumps*:* reciprocating pump, indicator diagram- acceleration head- effect of friction- use of air vessels- work saved- Slip- efficiency- pump characteristics applications.

Theory and application of self-priming pump, jet pump, airlift or compressor pump, slurry pump, hydraulic ram- Positive displacement Rotary pumps*:* Gear, screw, vane pumps. Hydraulic accumulator, intensifier, fluid coupling and lift- principle of operation- hydraulic cranes, hydraulic press- Hydraulic symbols (Description only, no problems).

COURSE OUTCOMES:

At the end of the course students will be able to

- Understand the basic working principles behind various hydraulic machineries.
- Understand about the non-dimensional parameters.
- Understand about various compressors.
- Know about different types of turbines.
- Know various types of pumps and their characteristic curves.

TEXT BOOKS:

1. Jagadishlal, Hydraulic Machines, Metropolitan Publishers, 2015.
2. Subramanya, K., Hydraulic Machines, Tata McGraw Hill, 1st edition, 2017

REFERENCE BOOKS:

1. R.K.Rajput, Hydraulic Machines, S.Chand & Company, 2016
2. Modi & Seth, Hydraulic Machines, Laxmi Publications, New Delhi, 2015.
3. Stepanoff A. J, Centrifugal and axial flow pumps, John Wiley & sons, 2017.
4. Som S K, Biswas G, Introduction to fluid mechanics and fluid machines, TMH, 2012.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ME24 403	MECHANICS OF DEFORMABLE SOLIDS	3-1-0-4

PRE-REQUISITES: Engineering Mechanics

COURSE OBJECTIVES:

- To acquaint with the basic concepts of stress and deformation in solids.
- To practice the methodologies to analyze stresses and strains in simple structural members and to apply the results in simple design problems.
- To design safe and durable structures and optimize material selection.
- To find the relationship between deflection and span of the beam.
- To study the behavior of square and circular columns in axial compression.

SYLLABUS:

Module I: **(10 hours)**

Tension, compression and shear, Types of external loads-self weight-internal stresses- normal and shear stresses- strain- Hooke's law- Poisson's ratio- relationship between elastic constants-stress strain diagrams working stress

Elongation of bars of constant and varying sections-statically indeterminate problems in tension and compression- thermal stresses- strain energy in tension-compression and shear Analysis of stress and strain, Stress on inclined planes for axial and biaxial stress fields-principal stresses.

Module II: **(11 hours)**

Bending moment and shearing force. Different types of beams-shear force and bending moment diagrams for simply supported and cantilever beams-relationship connecting intensity of loading-shearing force and bending moment- Stresses in laterally loaded symmetrical beams.

Module III: **(10 hours)**

Theory of simple bending- limitations bending stresses in beams of different cross-sections-moment of resistance- beams of uniforms strength- beams of two materials- principal stresses in bending- strain energy due to bending-shearing stresses in bending.

Module IV: **(10 hours)**

Deflection of beams. Differential equation of the elastic curve-Slope and deflection of beams by method of successive integration- Macaulay's method- moment area method- conjugate beam method.

Module V: **(11 hours)**

Theory of columns. Axial loading of short strut-long columns- Euler's formula- Rankine formula- Secant formula- eccentric loading- direct bending stress.

Torsion-Torsion of circular solid and hollow shafts- Power transmission- strain energy in shear and torsion- close coiled and open coiled helical springs.

Thin and thick cylinder. Lame’s equation- stresses in thick cylinders due to internal and external pressures- compound cylinders.

COURSE OUTCOME:

At the end of the course students will be able to

- Understand basic concepts of stress and strain in solids.
- Determine the stresses in simple structural members such as shafts, beams, columns etc. and apply these results in simple design problems.
- Determine principal planes and stresses, and apply the results to combined loading case.
- Analyze the different methods of unsymmetrical bending.
- Create stress-strain model for any mechanical component.

TEXT BOOKS:

1. Rattan, Strength of Materials, 2e McGraw Hill Education India, 2011
2. S.Jose, Sudhi Mary Kurian, Mechanics of Solids, Pentagon, 2015

REFERENCE BOOKS:

1. S. H. Crandal, N. C. Dhal, T. J. Lardner, An introduction to the Mechanics of Solids, McGraw Hill, 1999.
2. R. C. Hibbeler, Mechanics of Materials, Pearson Education, 2008.
3. I.H. Shames, J. H. Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, 2006.
4. James M.Gere, Stephen Timoshenko, Mechanics of Materials, CBS Publishers & Distributors, New Delhi, 2012.
5. F. Beer, E. R. Johnston, J T DeWolf, Mechanics of Materials, Tata McGraw Hill, 2011.
6. A. Pytel, F. L. Singer, Strength of Materials, Harper & Row Publishers, New York, 1998.
7. E. P. Popov, T. A. Balan, Engineering Mechanics of Solids, Pearson Education, 2012.
8. R. K. Bansal, Mechanics of solids, Laxmi Publications, 2004.
9. P. N. Singh, P. K. Jha, Elementary Mechanics of Solids, Wiley Eastern Limited, 2012.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

ME24 404	ENGINEERING MATERIALS & APPLICATIONS	3-1-0-3

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To understand the basic crystal structures (BCC, FCC, and HCP), and their relationship with the properties.
- To obtain a clear idea about diffusion and solidification of a pure metals.
- Analyze the microstructure of metallic materials using phase diagrams and modify the microstructure and properties using different heat treatments.
- To study mechanism behind elastic and plastic deformation in metals.
- To obtain knowledge about various engineering materials.

SYLLABUS:

Module I: **(10 hours)**

Crystallography- crystal systems, BCC, FCC and HCP systems, atomic packing factor, miller indices- crystal planes and directions, imperfections in solids- point defects, line defects, surface defects, volume defects. Techniques and instruments for metallographic studies- specimen preparation, etching, common etchants, grain size determinations, X-ray diffraction, optical microscopy, electron microscopy (SEM and TEM).

Module II: **(10 hours)**

Diffusion- mechanisms of diffusion, Fick's laws of diffusion, applications; Solidification of metals- Homogenous and Heterogeneous nucleation, crystal growth; Equilibrium diagrams- solidification of a pure metal, Hume-Rothery rules, classification of phase diagrams , Gibbs phase rule plotting of equilibrium diagrams, lever rule, Cu-Ni isomorphous system, Pb-Sn eutectic system.

Module III: **(11 hours)**

Fe-Fe3C phase diagram- features and reactions. Phase transformation in Iron- carbon alloys- TTT diagram, CCT diagrams. Heat treatment of steels- Annealing, normalizing, hardening and hardenability- Jominy End- quench test, Tempering, Case and surface hardening of steels.

Module IV: **(11 hours)**

Deformation of metals- Elastic deformation, Plastic deformation of metals- slip, slip systems- slip planes and slip directions, Schmid's law, Twinning; Strengthening mechanisms- Grain size reduction, solid solution strengthening, strain hardening; Recovery, recrystallisation and grain growth, Precipitation hardening.

Module V: **(10 hours)**

Composites- particle reinforced, fiber reinforced and structural composites, ceramics- application and properties, polymers- structure, properties and application, polymers- structure, properties and application, Modern engineering materials- smart materials, bio-materials, shape memory alloys, nuclear materials.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyze the Structure of materials at different levels and associate it with the basic concepts of crystalline materials.
- Understand the concept of phase and phase diagram. Construction and identification of phase diagrams and reactions correlate the micro structure with properties and performance of metals.
- Understand the effect of heat treatment in steel and explain the features and classifications of various ferrous and non-ferrous alloys.
- Understand the concept of mechanical behavior of materials.
- Explain features, classification and applications of newer class materials.

TEXT BOOKS:

1. William D. Callister, Materials Science and Engineering, John Wiley and sons, 2018.
2. V. Raghavan, Materials Science and Engineering, 5th Edition, Prentice Hall, India, 2007.
3. Dr. V. D Kodgire, Dr. S V Kodgire, Material Science and Metallurgy, 36th Edition, Everest publishing house, 2015.

REFERENCE BOOKS:

1. Avner S. H., Introduction to Physical Metallurgy, McGraw Hill, 2017.
2. Lawrence H Van Vlack, Elements of Material Science and Engineering, Pearson Education, 2002.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% -Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question

ME24 405	MANUFACTURING TECHNOLOGY I	3-1-0-3

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To gain theoretical and practical knowledge in material casting processes.
- To develop an understanding of the dependent and independent variables which control materials casting in a production setting.
- Introduce students to good foundry practices and various casting processes.
- Provide an overview of joining processes; discuss in detail the welding process and the physics of welding.
- Introduce students to different welding processes weld testing and advanced processes to be able to appreciate the practical applications of welding.

SYLLABUS:

Module I: **(10 hours)**

Introduction to Foundry- Steps involved in casting, advantages, dis advantages and applications of casting process. Pattern types, allowances for pattern, pattern materials, Moulding methods and processes-materials, equipment, Moulding sand ingredients, essential requirements, sand preparation and testing, cores and core making. Design considerations in casting, gating and Riser.

Module II: **(11 hours)**

Casting Processes: Sand casting, Shell Mould Casting- Ceramic Mould Casting- Investment Casting- Vacuum Casting- Slush Casting- Pressure Casting- Die Casting- Centrifugal Casting- CO_2 Casting- squeeze casting- Expended polystyrene process- Semi solid casting-rapid solidification - Casting defect- inspection and testing of castings.

Module III: **(10 hours)**

Principle of welding, general concepts of weldability, Classification of welding and allied processes. Capabilities and applications; welding parameters, welding metallurgy and weldment design, Gas welding and gas cutting, Arc welding- shielded metal arc welding, GTAW, GMAW, SAW, ESW- Power sources and consumables.

Module IV: **(11 hours)**

Resistance welding: Spot, Projection and seam welding process, Atomic hydrogen, ultrasonic, Plasma and laser beam welding and Electron beam welding and special welding processes e.g. TIG, MIG, friction and explosive welding, Inspection of welds- destructive and non-destructive testing methods, Defects in welding causes and remedies-effect of gases in welding-fatigue failure in weldments.

Module V: **(10 hours)**

Brazing, Soldering- different types of brazing- Theory of soldering and Brazing- Fluxes- Heat sources and heat transfer- Filler materials- Braze welding.

Adhesive Bonding- physical aspects- Surface energy and contact angle- Capillary action- Adhesives Bonding- Contact adhesives- Polyester, polyamide and polyurethane melt adhesives- Toughened acrylic and epoxy adhesives- Joining of ceramics- Metal/Ceramic joining /ceramic joining- Diffusion bonding.

COURSE OUTCOMES

At the end of the course students will be able to

- Get an idea for selecting materials and accessories used in a metal casting process.
- Provide an Understanding of different casting processes.
- Provide an exposure to different welding processes and parameters which control them.
- Familiarize with special welding methods and defects in welding.
- Explain the principles of brazing and soldering process

TEXT BOOKS:

1. Serope Kalpakjian, Manufacturing Engineering & Technology, Pearson Education, 7th edition, 2018.
2. P C Sharma, A Textbook of Manufacturing Technology, S. Chand Publishing, 2007.
3. R K Jain, Production Technology, Khanna Publishers, 2001.

REFERENCE BOOKS:

1. Black, Kohser, DeGarmo's, Materials and Processes in Manufacturing, Wiley, 2017.
2. Richard W. Heine, Carl R. Loper, Philip C. Rosenthal, Principles of Metal Casting, Tata McGraw-Hill Education, 2001.
3. Paul Degarma E, Ronald A. Kosher, Materials and Processes in Manufacturing, Wiley, 2011.
4. P. N. Rao, Manufacturing Technology Foundry, Forming and Welding, Tata McGraw Hill Education, 2011.
5. HMT Production Technology, McGraw Hill, 2001.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Total Marks- 100)
PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question

EN24 406	CONSTITUTION OF INDIA	3-1-0-0

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To realise the significance of constitution of India to students from all walks of life.
- To understand the basic concepts of Indian constitution.
- To identify the importance of fundamental rights as well as fundamental duties.
- To understand the functioning of Union, State and Local Governments in Indian federal system.
- To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

SYLLABUS:

Module I: **(12 hours)**

Historical Background- Constituent Assembly Of India- Philosophical Foundations Of The Indian Constitution- Preamble- Fundamental Rights- Directive Principles Of State Policy- Fundamental Duties- Citizenship- Constitutional Remedies For Citizens.

Module II: **(10 hours)**

Union Government- Structures of the Union Government and Functions- President- Vice President- Prime Minister- Cabinet- Parliament- Supreme Court of India- Judicial Review.

Module III: **(10 hours)**

State Government- Structure and Functions- Governor- Chief Minister- Cabinet- State Legislature- Judicial System in States- High Courts and other Subordinate Courts.

Module IV: **(10 hours)**

Local Administration- District Administration- Municipal Corporation- Zila Panchayat, Election Commission- Role and Functioning- Chief Election Commissioner- State Election Commission.

Module V: **(10 hours)**

Types of emergency- grounds- procedure- duration and effects. Amendment of the constitution- meaning- procedure and limitations.

COURSE OUTCOMES:

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

- Understand the emergence and evolution of Indian Constitution.
- Understand the structure and composition of Indian Constitution.
- Understand and analyse federalism in the Indian context.
- Understand and analyse the three organs of the state in the contemporary scenario.
- Understand and evaluate the Indian Political scenario amidst the emerging challenges.

TEXT BOOKS:

1. D D Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi, 24e, 2019.
2. P M Bhakshi, The constitution of India, Universal Law, 14e, 2017.

REFERENCE BOOKS:

1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008.
2. The Constitution of India B.L. Fadia Sahitya Bhawan, New edition.
3. J N Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019.
4. M V Pylee, India‘s Constitution, S Chand and company, New Delhi, 16e, 2016

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

ME24 407A	STRENGTH OF MATERIALS	3-0-0-3

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To understand and analyze various types of loads, stresses and strains along with main causes of failure of machine parts.
- Pre-requisite for understanding principles of Machine design.
- Understanding mechanical properties of materials which help in selecting the suitable materials for various engineering applications.
- Analyze and understand different internal forces and stresses induced due to representative loads on structural elements.
- Understand the basic concept of analysis and design of structural elements such as columns and struts

SYLLABUS:

Module I: **(10 hours)**

Simple stresses and strains viz. tensile, compressive, Shear, Crushing, Thermal stresses and corresponding strains, Hook's Law- Problems on Direct Stress and Linear Strain- Stress- Strain curve for ductile material and Brittle material with all parameters- Factor of Safety. Elastic Constants- Lateral Strain, Poisson's ratio, Bulk Modulus, Shear Modulus, Volumetric Strain, Relation between elastic constants- Problems on elastic constants.

Module II: **(11 hours)**

Definition- Shear Force and Bending Moment- Types of beams, types of loads acting on beams, Sagging and Hogging Bending Moment and its importance- sign convention to draw SFD and BMD- Concept of Maximum bending moment, Point of Contra flexure and its importance- Drawing S.F and B.M Diagram for Cantilever, Simply Supported Beams subjected to Point Load and U.D.L.

Module III: **(10 hours)**

Introduction, assumptions in theory of simple bending. Bending stress, relation between bending stress and radius of curvature (without proof) - Position of neutral axis, moment of resistance- Bending equation (without proof) - Modulus of section for rectangular, hollow rectangular and hollow circular sections- Beams of uniform Strength- problems.

Module IV: **(11 hours)**

Introduction to Torsion, Angle of Twist, Polar Moment of Inertia, Torsion equation- (without proof)- Assumptions in theory of Torsion- Power Transmitted by a shaft, axle of solid and hollow sections subjected to Torsion- Comparison between Solid and Hollow Shafts subjected to pure torsion- Problems. (No problem on composite and non-homogeneous shaft)

Module V: **(10 hours)**

Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns- Problems.

Activity for assessment - Market Survey specific to properties of various type of Materials used in Mechanical Engineering and make report

COURSE OUTCOME:

At the end of the course students will be able to

- Understand and distinguish the behavior of simple load carrying members subjected to an axial, shear and thermal Loading.
- Draw and Compare the shear force and bending moment diagram on beams under varying load conditions.
- Assess Bending and shear stresses in beams subjected to different loadings for different machine parts
- Design simple solid and hallow shaft for power transmission keeping view of Environmental and sustainability aspects
- Evaluate the behavior of columns and struts.

TEXT BOOKS:

1. Ramamurtham. S., Strength of Materials, 14th Edition, Dhanpat Rai Publications, 2011
2. Khurmi R S, Applied Mechanics and Strength of Materials, 5th Edition, S. Chand & Co.

REFERENCE BOOKS:

1. R. K. Bansal, Mechanics of solids, Laxmi Publications, 2004.
2. E. P. Popov, T. A. Balan, Engineering Mechanics of Solids, Pearson Education, 2012.
3. P. N. Singh, P. K. Jha, Elementary Mechanics of Solids, Wiley Eastern Limited, 2012.
4. S. H. Crandal, N. C. Dhal, T. J. Lardner, An introduction to the Mechanics of Solids, McGraw Hill, 1999.
5. R. C. Hibbeler, Mechanics of Materials, Pearson Education, 2008.
6. I.H. Shames, J. H. Pitarresi, Introduction to Solid Mechanics, PHI, 2006.
7. James M. Gere, Stephen Timoshenko, Mechanics of Materials, CBS Publishers & Distributors, New Delhi, 2012.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

ME24 407B	FLUID MECHANICS & HYDRAULIC MACHINERY	3-0-0-3

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To study the mechanics of fluid motion
- To develop understanding about basic laws and equations used for analysis of static and dynamic fluids
- To familiarize students with the relevance of fluid mechanics to many engineering systems
- To study basics about pumping machinery
- To familiarize with model laws and to do model analysis

SYLLABUS:

Module I: **(10 hours)**

Fluids and continuum, Physical properties of fluids, Newton's law of viscosity. Ideal and real fluids, Newtonian and non-Newtonian fluids. Fluid Statics- Pressure- density- height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, measurement of pressure.

Module II: **(10 hours)**

Eulerian and Lagrangian approaches, classification of fluid flow, 1-D, 2-D and 3-D flow, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, stream lines, path lines, streak lines, stream tubes, Discharge- continuity equation, velocity and acceleration in fluid, circulation and vorticity, stream function and potential function.

Module III: **(11 hours)**

Dynamic of fluid flow: energies in flowing fluid-pressure head, dynamic head, static head, total head- Euler's equation of motion and integration of Euler's equation of motion along a streamline-Bernoulli's equation and its limitations-applications of Bernoulli's equation venturi meter, orifice meter, pitot tube, orifices and mouthpieces, notches and weirs. Momentum Principle- Steady flow momentum equation-momentum and energy correction factors.

Module IV: **(11 hours)**

Dynamic Action of Fluid*:* Impulse Momentum equation- applications- impact of jet- flow of an incompressible fluid over fixed and moving vanes- workdone and efficiency- reaction principle- propulsion of ships.
Non dimensional parameters in fluid mechanics and fluid machinery- principle of similitude, geometric, kinematic and dynamic similarity- model studies. Non dimensional numbers (Reynold's number, Froude's number, Euler's number, Weber's number and Mach's number)

Module V: **(10 hours)**

Pumping machinery*:* General classification- Rotodynamic pumps- construction features, classification of impellers, impeller shapes- types of casings- working of centrifugal pumps,

priming, Euler`s head equation- velocity triangles- losses, head and efficiencies- performance pump characteristics: main, operating characteristics curves- selection of pumps from performance curves- NPSH required- NPSH available- multistage pumps- pumps in parallel and series operation.

COURSE OUTCOMES:

At the end of the course students will be able to

- Familiarize with various fluid properties and to calculate pressure variation and forces in static fluids.
- Calculate pressure variations in accelerating fluids using Euler's and Bernoulli's equations.
- Become conversant with the concepts of flow measurements and flow through pipes.
- Familiarize with pumping machinery.
- Understand about dynamic action of fluid and model analysis.

TEXT BOOKS:

1. Balachandran P, Engineering fluid mechanics, PHI.
2. S. K. Som, G Biswas, Fluid Mechanics, Tata McGraw Hill.
3. D.S. Kumar, Fluid Mechanics & Fluid Power Engg, S Kataria & Sons.
4. R. K. Bansal, Fluid Mechanics & Hydraulic Machines, Laxmi Publications.
5. R.K. Rajput, Fluid Mechanics, S Chand and Company.

REFERENCE BOOKS:

1. Cengel, Fluid Mechanics, McGraw Hill Education India.
2. Douglas, Fluid Mechanics, Pearson Education.
3. White F.M., Fluid Mechanics, Tata McGraw Hill.
4. Fox, Mc Donald, Introduction to Fluid Mechanics, John Wiley.
5. F.M. Streeter, Fluid Mechanics, Tata McGraw Hill.

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% -Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Regularity in the class

University Examination Pattern (Maximum Marks-100)
PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question

ME24 408 (P)	STRENGTH OF MATERIALS LAB	0-0-3-1

PRE-REQUISITES: Mechanics of Deformable Solids

COURSE OBJECTIVES:

- To provide knowledge on the mechanical behavior of materials.
- To acquaint with the experimental methods to determine the mechanical properties of materials.
- To evaluate product designs, analyze a field failure or optimize a product.
- To select appropriate materials for end use applications.
- To verify a production method or conditions.

SYLLABUS:

List of Experiments

1. Use screw gauge and Vernier caliper to measure the diameter of a steel rod and thickness of a flat bar. Determine the unit weight of the specimens.
2. Standard tension test on mild steel using Universal Testing Machines and suitable extensometers
3. Compression Testing Machine- Stress-strain characteristics of brittle materials- cast iron.
4. Spring test- open and closed coiled springs- determination of spring stiffness and modulus of rigidity
5. Determination of modulus of rigidity of wires
6. Hardness tests - Brinell hardness, Rockwell hardness (B S C scales), Rockwell superficial hardness (N & T Scales) and Vickers hardness
7. lmpact test - Izod and Charpy
8. Bending test on wooden beams
9. Fatigue testing - study of testing machine
10. Torsion test on mild steel rod
11. Shear test on mild steel rod

COURSE OUTCOMES:

At the end of the course students will be able to

- Apply knowledge of mathematics, science and engineering.
- Understand the impact of engineering solutions in a global and engineering context.
- Determine hardness of metals.
- Understand the behaviour of engineering component subjected to cyclic loading and failure concepts.
- Evaluate the strength of ductile and brittle materials subjected to compressive, Tensile shear and bending forces

REFERENCE BOOKS:

1. G.E. Dieter, Mechanical Metallurgy, McGraw Hill, 2017.
2. J W Dally, W F Riley, Experimental stress analysis, McGraw Hill, 1991.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

Semester End Examination (Maximum Marks-100)

70% - Procedure, conducting experiment, result, tabulation, and inference

20% - Viva voce

10% - Fair record

ME24 409 (P)	PRODUCTION ENGINEERING LAB I	0-0-3-1

PRE-REQUISITES: Manufacturing Technology I

COURSE OBJECTIVES:

- To familiarize with various measuring tools, surface finish and tolerance.
- To acquire knowledge about various machining processes.
- To acquaint with the basic operations of centre lathe.
- To acquire knowledge about CNC lathe.
- To conduct the exercise involving plane turning, groove cutting, taper turning, facing, thread cutting and grinding operations.

SYLLABUS:

Study of Machines

1. Study of machine tools and machining processes- specification of machine tools- power sources.
2. Study of centre lathe- general features, parts and functions- different machining operations on centre lathe- turning, taper turning, thread cutting, drilling, boring, reaming, tapping, profile turning, knurling.
3. Study of tolerances and surface finish – measuring tools and gauges.
4. Study of CNC lathe.

List of exercises

1. Plane turning and Step turning on lathe.
2. Groove turning (cup and ball) and taper turning on lathe.
3. Single start thread cutting, multi-start thread cutting, square thread cutting, and internal thread cutting operations on lathe
4. Knurling operation on lathe.
5. Turning, step turning operations on CNC lathe

COURSE OUTCOMES:

At the end of the course the students will be able to

- Operate different machine tools using proper work holders
- Understand about various machining operations.
- Produce different part features to the desired quality.
- Do various operations on lathe.
- Understand basic features of CNC lathe

REFERENCE BOOKS:

1. W. A. J. Chapman, Workshop Technology Part I, ELBS & Edward Arnold Publishers, 1972.
2. J. Anderson, Shop Theory, Tata McGraw Hill, 2017.
3. S.K. Hajra Choudhury, Workshop Technology Vol II, Media Promoters & Publishers, 2008.
4. R.K. Jain, Production Technology, Khanna Publishers, 2001.
5. R. Quesada, T. Jeyapoovan, Computer Numerical Control, Pearson Education, 2004.

Internal Continuous Assessment (Maximum Marks-50)

60% - Workshop practical (models) and record

30% - Tests

10% - Regularity in the lab

Semester End Examination (Maximum Marks-100)

70% - Making of models considering completion, dimensional accuracy, finishing methods, choice of proper tools etc.

20% - Viva voce

10% - Fair record