UNIVERSITY OF CALICUT

Abstract

General and Academic Branch - Faculty of Engineering- B.Tech programme - OBE based Curriculum and Syllabus of first to eighth semester Mechanical Engineering and Printing Technology, w.e.f 2019 Admn onwards - Implemented subject to ratification by the Academic Council - Orders issued.

G & A - IV - E

U.O.No. 7632/2021/Admn Dated, Calicut University.P.O, 05.08.2021

Read:-1. Minutes of the Board of Studies in Mechanical Engineering held on 10.06.2021

2. Item no.1 of the minutes of the meeting of the Faculty of Engineering held on 07.07.2021

3. Orders of Vice -chancellor in the file 234359/GA-IV-E1/2018/Admn dt.02.08.2021

ORDER

1. The meeting of the Board of Studies in Mechanical Engineering, vide paper read (1) above, presented and approved the Syllabus of Mechanical Engineering (ME) and Printing Technology (PT) (2019 scheme) from semester 5 to semester 8.
2. The Faculty of Engineering held on 07.07.2021 approved the Syllabus of B.Tech (2019 Scheme) of Mechanical Engineering (S5-S8) Printing Technology (S5-S8). Thus the OBE based syllabus of both Mechanical Engineering and Printing Technology up to 8th semester has been approved by the Fa, as per paper read (2) above.
3. Considering the urgency, the Vice Chancellor has accorded sanction to implement the OBE based curriculum and syllabus of Mechanical Engineering and Printing Technology up to 8th semester,subject to ratification by Academic Council, vide paper read (3) above.
4. Orders are issued accordingly. (Curriculum and Syllabus of all semesters of Mechanical Engineering and Printing Technology - w.e.f 2019 Admission onwards appended)

Arsad M

Assistant Registrar

To

1. The Principal, CUIET.
2. The Controller of Examinations.

Copy to:PA to VC/PA to Registrar/PA to CE/DR, B.Tech/EX & EG sections/ GA I F/SF/DF/FC

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

CURRICULUM
&
SYLLABUS

(1 TO 8 SEMESTERS)

B. Tech – Mechanical Engineering

(2019 SCHEME)

(Applicable to 2019 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	12
2	Basic Science courses	24
3	Engineering Science Courses	19
4	Program Core Courses	65
5	Program Elective Courses	15
6	Open Elective Courses	3
7	Internship, Seminar, Project work and Course- Viva	15
8	Mandatory Non-credit Courses	---
9	Practical sessions	16
10	Mandatory Student Activities	1
	Total Mandatory Credits	170
11	Value Added Course (Optional)	20

Semester-wise credit distribution shall be as below:

Semester	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Credits	19	19	21	20	22	23	22	23	169
Activity Points	50/25*				50				100/75*
Credits for Activity	1								1
Grand Total									**170**

***applicable for Lateral Entry (LE) students**

BASIC SCIENCE COURSES: Maths, Physics, Chemistry, Biology for Engineers, Life Science etc.

ENGINEERING SCIENCE COURSES: Basic Electrical, Engineering Graphics, C Programming, Basic Electronics, Basic Civil, Engineering Mechanics, Basic Mechanical etc.

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES: Economics, Principles of management, Operations Research, Operations Management, Industrial Engineering and Systems Management.

MANDATORY NON-CREDIT COURSES: Environmental Science, Constitution of India, Life Skills & Ethics for Engineers, Communicative English, and Concept based Engineering. There will be only internal evaluation of non-credit courses, and no University examinations will be conducted. A minimum 50% internal mark is to be obtained for securing a pass in these subjects. A student has to pass the exam within 4 chances, failing which the student has to undergo course repeat for the subject.

VALUE ADDED COURSE: Students can attend various value added MOOCs (Massive Open Online Courses) like NPTEL courses conducted by nationally or internationally reputed institutions within like IIT, IIST etc., and abroad (from foreign universities) and earn a maximum of 20 additional credits for getting 'Honours' degree in the discipline with a condition that he/she should have secured an aggregate of 8.0 CGPA up till final semester without any history of backlogs. Thus, the candidate can earn a max of 190 credits during his/her period of studies up to 8th semester. The selected course can be on same discipline or in any other relevant discipline pertaining to engineering/management/social science. 4 credits will be awarded to a student on successful completion of each MOOC. Thus, a student will be eligible to get an undergraduate degree with 'Honours' when he/she successfully earns an additional requirement of 20 credits through the successful completion of 5 MOOCs.

Successful completion of a MOOC is considered only when a student scores a minimum score of 60 (or equivalent to 60%) and above in the respective course. The additional value-added MOOC courses can be of 8 – 12-week duration. Each student who wish to do a MOOC should take prior permission from the respective Head of the Department, registering for the same with the institution which is hosting the course. The Head of the Department should verify the details of the course and ensure that the course content is relevant to his/her discipline before giving the approval. The details of MOOC courses undertaken by a student (if any) and the credits earned must be consolidated by the Tutor, forwarded by HOD and approved by Principal. The same has to be entered in the University portal by the college officials before the commencement of every end semester university examination.

HONOURS

Calicut University is providing this option for academically extra brilliant students to acquire Honours. Honours is an additional credential; a student may earn if she/he opts for the extra 20 credits needed for this in her/his own discipline with a condition that he/she should not have failed in any of the subjects till final semester and have secured an aggregate of 8.0 CGPA up till final semester. Honours is not indicative of class. Honours is intended for a student to gain expertise/specialise in an area inside his/her major B-Tech discipline to enrich knowledge in emerging/advanced areas in the branch of engineering concerned and interdisciplinary areas including management. 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 her/his branch of engineering and allied sectors. On successful achievement of 20 credits from the honours and 170 credits from their respective B Tech syllabus, the student will earn a total credit of 190 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 marks up to seventh semester and the number of value-added courses and credits earned before the commencement of the 8th semester university examination.

COURSE CODE AND COURSE NUMBER

Each course is denoted by a unique code consisting of three alphabets followed by three numerals like ME19 807 (P)**.** The first two letter code refers to the department offering the course. ME stands for Mechanical Engineering. The second two digits represent the year in which the syllabus is implemented, thus the digit 19 represents the year 2019. Out of the next three digits, the first digit represents the semester in which the subject belongs, Eg: in 807, 8 means 8th semester and 07 is the 7th subject in that semester. The last alphabet represents whether the subject belongs to the Practical or laboratory category. Eg: (P) Means the subject belongs to the Practical category.

L-T-P STRUCTURE

Notations	Description
L	Lecture hours- For theory-based courses hours are represented in this form Eg: 3-0-0, means 3 hour 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, 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 means one hour is dedicated for the above mentioned purpose.

Description
Theory based courses (other the lecture hours, these courses can have tutorial and practical hours, e.g., L-T-P structures 3-0-0, 3-1-2, 3-0-2 etc.)
Laboratory based courses (where performance is evaluated primarily on the basis of practical or laboratory work with LTP structures like 0-0-3, 1-0-3, 0-1-3 etc.)

DEPARTMENTS

Each course offered by a Department and their two-letter course prefix is given in Table

Departments and their codes

Sl.No	Department	Course Prefix
01	Electrical & Electronics Engineering	EE
02	Electronics & Communication Engineering	EC
03	Information Technology	IT
04	Mechanical Engineering	ME
05	Printing Technology	PT

INDUCTION PROGRAM

A mandatory induction program for first semester students is designed for three weeks. This unique three 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:

The programme is designed to attain the following objectives:

- **Values and Ethics**: Focus 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.

SUBJECTS AND GROUPS IN 1st and 2nd SEMESTER			
GROUP	**SUBJECT CODE**	**SUBJECT NAME**	**COMP/OPT**
A	MA19 100	Calculus and Linear Algebra	COMP FOR SEM1
	MA19 200	Differential Equations and Vector Calculus	COMP FOR SEM 2
B	CH19 100	Engineering Chemistry	OPT (1/2) IN BOTH SEMESTERS
	PH19 100	Engineering Physics	
C	GS19 100	Engineering. Graphics	OPT (1/2) IN BOTH SEMESTERS
	EM19 100	Engineering Mechanics	
D	EC19 100	Concepts of Electronics Engineering	COMP FOR EC IN SEM 1
	EE19 100	Concepts of Electrical Engineering	COMP FOR EE IN SEM 1
	ME19 100	Concepts of Mechanical Engineering	COMP FOR ME IN SEM 1
	IT19 100	Introduction to Computing and Problem Solving	COMP FOR IT IN SEM 1
	PT19 100	Concepts of Printing Technology	COMP FOR PT IN SEM 1
E*	EC19 101	Basics of Electronics Engineering	OPT (1/4) FOR SEM1 & OPT (2/4) FOR SEM 2 RELEVANT SUBJECTS
	EE19 101	Basics of Electrical Engineering	
	CE19 101	Basics of Civil Engineering	
	ME19 101	Basics of Mechanical Engineering	
F	ES19 100	Environmental Science	COMP FOR SEM 1
	DE19 200	Concept Based Engineering	COMP FOR SEM 2
G	CH19 100(P)	Engineering Chemistry Lab	OPT (1/2) IN BOTH SEMESTERS
	PH19 100(P)	Engineering Physics Lab	
H**	EE19 100(P)	Electrical Engineering Workshop	OPT (2/4) IN BOTH SEMESTERS
	EC19 100(P)	Electronics Engineering Workshop	
	CE19 100(P)	Civil Engineering Workshop	
	ME19 100(P)	Mechanical Engineering Workshop	
	IT19 100(P)	Introduction to Computing and Problem Solving Lab	
	PT19 100 (P)	Printing Technology Workshop	
I	CM19 100	Communicative English	COMP FOR SEM 1
	LL19 200	Language Lab	COMP FOR SEM2

COMP- COMPULSORY SUBJECT

OPT – OPTIONAL SUBJECT

* Concerned branches have to avoid choosing Basic of Engineering (E) i.e., Mechanical Engineering students are not permitted to choose Basics of Mechanical Engineering and same is applicable for other branches also.

** EE19 100(P), EC19 100(P), ME19 100(P), IT19 100 (P), PT19 100 (P) are COMPULSORY for respective branches in SEMESTER 1.

SCHEME OF I SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Subject Code	**Subject Name**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	**T**	**P**	**Internal**	**End semester**		
MA19 100	Calculus and Linear Algebra	3	1	0	50	100	3	4
PH19 100/CH 19 100	Engineering Physics/ Engineering Chemistry	3	1	0	50	100	3	4
GS19 100/ EM19 100	Engineering Graphics/ Engineering Mechanics	3	0	2	50	100	3	4
		3	2	0				
ME19 100	Concepts of Mechanical Engineering	2	1	0	50	100	3	2
EC19 101/EE19 101/CE19 101	Basics of (Electronics/Electrical /Civil) Engineering	2	1	0	50	100	3	2
ES19 100	Environmental Science	2	0	1	100	-	-	0
CM19 100	Communicative English	2	0	0	100	-	-	0
PH19 100 (P)/CH19 100 (P)	Engineering Physics Lab/Engineering Chemistry Lab	0	0	2	100	-	3	1
CE19 100 (P)/EE19 100(P)	Civil/Electrical Engineering Workshop	0	0	2	100	-	3	1
ME19 100 (P)/EC19 100(P)	Mechanical/ Electronics Engineering Workshop	0	0	2	100	-	3	1
	Total	**30**			**750**	**500**		**19**

NOTE:

COMMUNICATIVE ENGLISH

Objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for their professional needs. Coverage: Listening, Barriers to listening, Steps to overcome them, Purposive listening practice, Use of technology in the professional world. Speaking, Fluency & accuracy in speech, Positive thinking, improving self-expression, Tonal variations, Group discussion practice, Reading, Speed reading practice, use of extensive readers, Analytical and critical reading practice, Writing Professional Correspondence, Formal and informal letters, Tone in formal writing, Introduction to reports. Study Skills, use of dictionary, thesaurus etc., Importance of contents page, cover & back pages, Bibliography, Language Lab.

SCHEME OF II SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
MA19 200	Differential Equations and Vector Calculus	3	1	0	50	100	3	4
PH19 100/ CH19 100	Engineering Physics/ Engineering Chemistry	3	1	0	50	100	3	4
GS19 100/ EM19 100	Engineering Graphics/ Engineering Mechanics	3	0	2	50	100	3	4
		3	2	0				
EC19 101/EE19 101/CE19 101	Basics of (Electronics/Electrical /Civil) Engineering	2	1	0	50	100	3	2
EC19 101/EE19 101/CE19 101	Basics of (Electronics/Electrical /Civil) Engineering	2	1	0	50	100	3	2
DE19 200	Concept Based Engineering (Design Engineering)	2	0	1	100	-	-	0
LL19 200	Language Lab	0	0	2	100	-	-	0
PH19 100 (P)/CH19 100 (P)	Engineering Physics Lab/Engineering Chemistry Lab	0	0	2	100	-	3	1
CE19 100 (P)/EE19 100(P)	Civil/Electrical Engineering Workshop	0	0	2	100	-	3	1
ME19 100 (P)/EC19 100(P)	Mechanical/ Electronics Engineering Workshop	0	0	2	100	-	3	1
	Total	**30**			**750**	**500**		**19**

SCHEME OF III SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
EN19 301	Engineering Mathematics III	3	1	0	50	100	3	4
ME19 302	Fluid Mechanics	3	1	0	50	100	3	4
ME19 303	Mechanics of solids	3	1	0	50	100	3	4
ME19 304	Metallurgy and Material Science	3	1	0	50	100	3	4
ME19 305	Electrical Technology	3	1	0	50	100	3	3
EN19 306	Life skills & Ethics for Engineers	2	0	2	100	-	-	0
ME19 307 (P)	Computer Assisted Machine Drawing	0	0	3	50	100	3	1
ME19 308 (P)	Electrical Technology Lab	0	0	3	50	100	3	1
	Total	**17**	**5**	**8**	**450**	**700**		**21**
		30						

NOTE:

LIFE SKILLS & ETHICS FOR ENGINEERS

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers. Professional ethics is highly needed for an engineer. This course will focus on to improvise the ethical quality of an engineer to meet the changing demands and requirements of the society.

SCHEME OF IV SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
EN19 401	Engineering Mathematics IV	3	1	0	50	100	3	4
ME19 402	Computer programming in C	2	0	2	50	100	3	3
ME19 403	Thermodynamics	3	1	0	50	100	3	4
ME19 404	Hydraulic Machinery	3	1	0	50	100	3	4
ME19 405	Manufacturing process I	3	1	0	50	100	3	3
EN19 406	Constitution of India	2	0	2	100	-	-	0
ME19 407 (P)	Material Testing Lab	0	0	3	50	100	3	1
ME19 408 (P)	Production Engineering Lab I	0	0	3	50	100	3	1
	Total	**16**	**4**	**10**	**450**	**700**		**20**
		30						

SCHEME OF V SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
EN19 501	Engineering Economics and Principles of Management	3	1	0	50	100	3	3
ME19 502	Manufacturing Process II	3	1	0	50	100	3	3
ME19 503	Heat and Mass Transfer	3	1	0	50	100	3	4
ME19 504	Mechanics of Machinery	3	1	0	50	100	3	4
ME19 505	Metrology and Instrumentation	3	1	0	50	100	3	3
ME19 506	Program Elective I	3	1	0	50	100	3	3
ME19 507 (P)	Fluid Mechanics and Machinery Lab	0	0	3	50	100	3	1
ME19 508 (P)	Production Engineering Lab II	0	0	3	50	100	3	1
	Total	**18**	**6**	**6**	**400**	**800**		**22**
		30						

Program Elective I	
ME19 506(A)	Energy Engineering Management
ME19 506(B)	Advanced Mechanics of Solids
ME19 506(C)	Data Analytics for Engineers
ME19 506(D)	Computational Methods in Engineering
ME19 506(E)	Marketing Management
ME19 506(F)	Advanced Metal Joining Techniques

SCHEME OF VI SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
ME19 601	Thermal Engineering	3	1	0	50	100	3	4
ME19 602	Machine Design I	3	1	0	50	100	3	4
ME19 603	Dynamics of Machinery	3	1	0	50	100	3	4
ME19 604	Operations Research	3	1	0	50	100	3	3
ME19 605	Program Elective II	3	1	0	50	100	3	3
ME19 606	Open Elective I	3	1	0	50	100	3	3
ME19 607 (P)	Thermal Engineering Lab I	0	0	3	50	100	3	1
ME19 608 (P)	Instrumentation Lab	0	0	3	50	100	3	1
	Total	**18**	**6**	**6**	**400**	**800**		**23**
		30						

*** Submission of report for internship done during the break of semester 6 can be done during the start of semester 7.**

Program Elective II		**Open Elective I**	
ME19 605(A)	Gas Dynamics & Jet Propulsion	ME19 606(A)	Product Design and Development
ME19 605(B)	Design of Jigs and Fixtures	ME19 606(B)	Quality Engineering and Management
ME19 605(C)	Finite Element Method	ME19 606(C)	Entrepreneurship & Business Analytics
ME19 605(D)	Non-Conventional Manufacturing Techniques	ME19 606(D)	Industrial Internet of Things
ME19 605(E)	Composite Materials	ME19 606(E)	Quantitative Technique for Engineers
ME19 605(F)	Tool Engineering and Design	ME19 606(F)	Disaster Management

NOTE:

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.

SCHEME OF VII SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
ME19 701	Industrial Engineering and Systems Management	3	1	0	50	100	3	3
ME19 702	Machine Design II	3	1	0	50	100	3	4
ME19 703	Mechatronics	3	1	0	50	100	3	3
ME19 704	Advanced Automobile Engineering	3	1	0	50	100	3	3
ME19 705	Program Elective III	3	1	0	50	100	3	3
ME19 706 (P)	CAD/CAM Lab	0	0	3	50	100	3	1
ME19 707 (P)	Thermal Engineering Lab II	0	0	3	50	100	3	1
ME19 708 (P)	Project phase I	0	0	4	100	-	-	3
ME19 709 (P)	Internship *	0	0	0	100	-	-	1
	Total	**15**	**5**	**10**	**550**	**700**		**22**
		30						

***Submission of report for internship done during the break of semester 6 can be done during the start of semester 7.**

Program Elective III	
ME19 705 (A)	Industrial Tribology
ME19 705 (B)	Acoustics and Noise Control
ME19 705 (C)	Technology Management
ME19 705 (D)	Micro and Nano Manufacturing
ME19 705 (E)	Heat Transfer Equipment Design
ME19 705 (F)	Heating Ventilation and Air-conditioning system

NOTE:

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. The Internship should give exposure to the practical aspects of the mechanical and allied engineering discipline. 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/systems 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

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 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;

- Final seminar, as oral presentation before the evaluation committee.

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 VIII SEMESTER B.Tech MECHANICAL ENGINEERING COURSE								
Code	**Subject**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	T	P	**Internal**	**End semester**		
ME19 801	Computer Integrated Manufacturing	3	1	0	50	100	3	3
ME19 802	Operations Management	3	1	0	50	100	3	3
ME19 803	Program Elective IV	3	1	0	50	100	3	3
ME19 804	Program Elective V	3	1	0	50	100	3	3
ME19 805 (P)	Seminar	0	0	6	100	-	-	2
ME19 806 (P)	Project Phase II	0	0	8	100	-	-	6
ME19 807 (P)	Viva Voce	0	0	0	-	100	-	3
	Total	**12**	**4**	**14**	**400**	**500**		**23**
		30						

Program Elective IV		**Program Elective V**	
ME19 803 (A)	Non-Destructive Testing	ME19 804 (A)	Renewable Energy Technology
ME19 803 (B)	Supply Chain Management	ME19 804 (B)	Aerospace Engineering
ME19 803 (C)	Industrial Safety Engineering	ME19 804 (C)	Additive Manufacturing
ME19 803 (D)	Hybrid and Electric Vehicles	ME19 804 (D)	Machine Learning and Applications
ME19 803 (E)	Cryogenic Engineering	ME19 804 (E)	Robotics and Automation
ME19 803 (F)	Lean Systems	ME19 804 (F)	Reliability and Industrial Maintenance

NOTE:

SEMINAR:

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 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 a 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

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

Anexure-I

Code	Name of activity	Max. Activity Points	Minimum Duration
i) National Level Activities			
NA1	N S O	70	Two Semesters
NA2	N C C	70	Two Semesters
NA3	N S S	70	Two Semesters
ii) College Level Activities			
CA1	Active Member/Office bearer of Professional Societies (Student Chapters)	30/40	Four Semesters
CA2	Elected Office bearer of Student forums	30	Two semesters
CA3	Member/Captain- College Athletic/ Games teams	20/30	Two Semesters
CA3	Executive Member of Student Clubs	20	Two Semesters
CA4	Volunteer for important College functions	20	Two Semesters
CA5	Committee member/ Organizer of Tech Fest/ Cultural Fest/ Conference	20/30	Two Semesters
CA6	Placed within top three in Paper presentation/debate/ cultural competitions etc.	30	
CA7	Placed within top three in State level Sports/Games	30	
Additional 20 points to be given for CA3/CA7 if the achievement is at the national level.			
iii) Entrepreneurship			
EA1	Any Creative Project Execution	40	
EA2	Awards for Projects	60	
EA3	Initiation of Start-ups	60	

EA4	Attracted Venture Capital	80	
EA5	Filed a Patent	80	
EA6	Completed Prototype Development	80	
	iv) Self Initiatives		
SA1	Attend a National Conference	20	
SA2	Attend an Int. National Conference	30	
SA3	Published/got an Award for a technical paper.	30/40	
SA4	Organizer of student technical Conf/Competition	30	
SA5	Foreign language skills	50	
SA6	Webinar related to the Engineering/Management/Social science (Max of Ten)	2	
SA7	Online courses taken & completed	Maximum 50	10 weeks

ACTIVITY POINTS: -

The Tutor, HOD and Principal must ensure that the students have acquired the required mandatory 50 activity points (25 activity points in the case of LE students) by the end of 4th and another 50 activity points by the end of 8th semester. The accumulated activity points of all students must be consolidated and entered in to the university portal by the college officials upon completion of the 4th semester (50/ 25 points) and the 8th semester (50 points) before the commencement of the respective University examinations.

GROUP A

MA19 100	CALCULUS AND LINEAR ALGEBRA	3-1-0-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To familiarize with functions of several variables that is essential in most branches of Engineering.
- To develop the tool of Power series for learning Advanced Engineering Mathematics.
- To develop the tool of Fourier series for learning Advanced Engineering Mathematics.
- To develop the essential tool of Matrices and Linear Algebra in a comprehensive manner.

SYLLABUS:

Module I: Sequences and Series. (12 hours)

Indeterminate forms and L'Hospital's rule; Definition of sequences and series; Convergence of sequence and infinite series, Tests for convergence of infinite series-Comparison test, Ratio test, Root test, Raabe's, Logarithmic test; convergence of Alternating series (Leibnitz's test), absolute convergence.

Module II: Power Series. (8 hours)

Taylor's and Maclaurin's theorems with remainders, Power series, Taylor's Series, Maclaurin's series, series for exponential, trigonometric, hyperbolic and logarithmic functions. Leibnitz formula for derivative of product of two functions.

Module III: Multivariable Calculus. (10 hours)

Functions of several variables; Limit, continuity and partial derivatives, total derivative; Maxima, minima and saddle points; Radius of curvature, Circle of curvature, evolutes and involutes.

Module IV: Fourier Series. (10 hours)

Periodic functions, Trigonometric series, Fourier series, Euler Formula, Even and Odd functions, Fourier series for Even and Odd functions, Functions having arbitrary period, Fourier series of functions having arbitrary period, Half range expansions, Half range sine and cosine series.

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; Quadratic forms; Orthogonal Transformation.

COURSE OUTCOMES:

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

- Use the derivatives to find critical points, inflection points and local extrema.
- Understand the basic concept of partial differentiation and its applications in engineering.
- Develop skills in computations and applications of infinite sequences and sums.
- Expand the periodic function by using Fourier series and apply it in signals and systems.
- Use matrices and determinants for solving system of linear equations and apply it in engineering problems.

TEXT BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

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

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)
20% - 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.

MA19 200	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	3-1-0-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To introduce effective mathematical tools for the solutions of differential equations that model physical process
- To acquaint with mathematical tools needed in evaluating multiple integrals and their usage.
- To familiarize with concept of vector differentiation and vector integration.

SYLLABUS:

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

Differential equations reducible to homogeneous, Exact, linear and Bernoulli's equations, Equations of the first order and higher degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairout's type. Applications of differential equations of first order- orthogonal trajectories.

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

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

Module III: Multiple integrals and their applications. (12 hours)

Double integrals (cartesian and polar co-ordinates), Change of order of integration of double integrals, change of variables (cartesian to polar), applications: areas and volumes, triple integrals, volume of solids, change of variables (rectangular to cylindrical, rectangular to spherical polar).

Module IV: 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, physical meaning, relation between the vector differential operators.

Module V: Vector integral calculus. (10 hours)

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

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 analyse differential equations in a wide range of physical phenomena and has got applications across all branches of engineering.
- Model physical phenomena involving continuous changes of variables and parameters
- Apply the concept of vector functions and learn to work with conservative vector field.
- Apply computing integrals of scalar and vector field over surfaces in three-dimensional space.

TEXT BOOKS/REFERENCE BOOKS:

1. G.B. Thomas and 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. E.A.Coddington, An introduction to ordinary differential equations, Prentice Hall 1995.
4. S L Ross, Differential Equation, 3rd ed., Wiley India 1984.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Internal Continuous Assessment *(Maximum Marks-50)*
70% - Tests (minimum 2)
20% - 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.

GROUP B

CH19 100	ENGINEERING CHEMISTRY	3-1-0-4

PRE-REQUISITE: 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, nanomaterial's, lubricants, fuels, storage devices, etc.
- To focus the students on the chemistry of compounds resulting from pollution, waste generation and environmental degradation and to apply the knowledge in solving these current environmental problems effectively.
- To develop abilities and skills that is relevant to the study and practice of chemistry.

SYLLABUS:

Module I: (10 Hours)

Water: hardness, determination of hardness by EDTA method, softening (lime-soda and ion exchange methods), numerical problems based on hardness and lime soda method, purification of water for domestic use.
Polymers: classification, addition polymerization (free radical, cationic, anionic, and coordination mechanism of polymerisation), condensation polymerization, crystallinity in polymers (amorphous, crystalline and semi-crystalline), concept of glass transition temperature (Tg), factors affecting Tg.
Conducting polymers: introduction, synthesis, structure, properties and applications of conducting polymers like polyacetylene and polyaniline.

Module II: (10 Hours)

Lubricants: classification of lubricants (solid, liquid, and semisolid), Mechanism of lubrication (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 of fuels, calorific value, determination of calorific value using bomb calorimeter; numerical problems based on calorific value, liquid fuels (petroleum), refining of petroleum, cracking and reforming, petrol knock and octane number, diesel knock and cetane number, bio-diesel.

Module III: (10 Hours)

Nanoscience: introduction, classification of nanomaterials, synthesis of nanomaterials (hydrolysis and reduction), fullerenes and carbon, nanotubes, properties and applications of CNTs.
Green chemistry : definition, importance and limitations, twelve principles of green chemistry with their explanations and examples.

Module IV: (10 hours)

Electrochemistry: electrochemical cells, salt bridge, Helmholtz double layer, single electrode potential, EMF and its measurement by Poggendorf's compensation method, determination of single electrode potential using SHE, electrochemical series and its applications, Nernst equation and its applications; numerical problems based on potential and Nernst equation,

Concentration cells (electrode and electrolyte concentration cells), glass electrode and pH measurement using glass electrode (Numerical problems).

Storage and fuel cells: lead acid accumulator and nickel cadmium battery, fuel cells, H_2/O_2 fuel cell, solar cells.

Module V: (12 hours)

Corrosion: theories of corrosion, dry corrosion (self-protecting corrosion products, pilling-bed worth rule), wet corrosion (corrosion of iron in acidic, neutral and basic conditions), galvanic corrosion and galvanic series, differential aeration corrosion, stress corrosion, factors influencing corrosion, corrosion control by cathodic protection.

Protective coatings: inorganic metallic coatings (galvanizing, tinning, cementation, electroplating), inorganic non-metallic coatings (phosphate, chromate, chemical oxide, anodising), organic coatings (paints).

COURSE OUTCOMES:

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

- Analyze 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 nanoscience and the significance of environmental protection by studying the green chemistry
- Streamline the worth of electrical storage using batteries or fuel cells by learning the electrochemistry
- List major chemical corrosion reactions and prevention methods that are used in the protection of metals

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Seymour R.B, Introduction to Polymer Chemistry, McGraw Hill, New York.
2. Billmeyar F.W, Text book of Polymer Science, Wiley Inter-science, 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, and 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. V.S. Muraleedharan and A. Subramania – Nano Science and Technology, Ane Books.
9. B. S. Bahl and ArunBahl S. Advanced Organic Chemistry, Chand & Company.
10. L. S. Brown and Thomas A. Holme, Chemistry for Engineering Students, Cengage Learning.
11. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishers.
12. Engineering Chemistry by P. Rath, Cengage Learning.
13. Engineering Chemistry by M.J Shultz, Cengage Learning, New Delhi.
14. Engineering Chemistry by R. Mukhopadhyay and S. Datta, New Age International Publishers.
15. A textbook of Engineering Chemistry by S. S. Dara and S. S. Umare, S. Chand Pvt Ltd.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)
20% - 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.

PH19 100	ENGINEERING PHYSICS	3-1-0-4

PRE-REQUISITE: 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 programmes.

SYLLABUS:

Module I: (10 hours)

Interference: coherence, interference in thin films and wedge shaped films (reflected system) Newton's rings; measurement of wavelength and refractive index of liquid, interference filters, antireflection coating.
Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, plane transmission grating, grating equation; measurement of wavelength, Rayleigh's criterion for resolution of grating, resolving power and dispersive power of grating.
Polarization of Light: types of polarized light, double refraction, Nicol Prism, quarter wave plate and half wave plate, production and detection of circularly and elliptically polarized light, induced birefringence; Kerr Cell, polaroid & applications.

Module II: (10 hours)

Quantum Mechanics: uncertainty principle and its applications, formulation of time dependent and time independent Schrodinger equations, physical meaning of wave function, energy and momentum operators, eigen values and functions, one dimensional infinite square well potential , quantum mechanical tunnelling (qualitative).
Statistical Mechanics: macrostates and microstates, phase space, basic postulates of Maxwell-Boltzmann, Bose-Einstein and Fermi Dirac statistics, distribution equations in the three cases (no derivation), Fermi level and its significance.

Module III: (10 hours)

Waves: one dimensional wave; differential equation and solution. three dimensional waves: differential equation and its solution (no derivation), transverse vibrations of a stretched string.
Acoustics: Intensity of sound, loudness, absorption coefficient, reverberation and reverberation time, significance of reverberation time, Sabine's formula (no derivation), factors affecting acoustics of a building.
Ultrasonics: production of ultrasonic waves; magnetostriction effect and piezoelectric effect, magnetostriction oscillator and piezoelectric oscillator, detection of ultrasonics; thermal and piezoelectric methods, applications of ultrasonics - NDT and medical.

Module IV: (12 hours)

Photonics: basics of solid state lighting, LED, photodetectors, photo voltaic cell, junction and avalanche photo diodes, photo transistors, thermal detectors, solar cells; V-I characteristics.
Optic fibres: principle of propagation-numerical aperture, optic fibre communication system (block diagram), industrial, medical and technological applications of optical fibre, fibre optic sensors, basics of intensity modulated and phase modulated sensors.

Module V: (10 hours)

Laser: properties of lasers, absorption, spontaneous and stimulated emissions, population inversion, Einstein's coefficients, working principle of laser, optical resonant cavity, Ruby laser, Helium-Neon laser, semiconductor laser (qualitative), applications of laser, holography (recording and reconstruction).
Superconductivity: superconducting phenomena, Meissner effect. Type-I and Type-II superconductors, BCS theory (qualitative), high temperature superconductors, Josephson Junction, SQUID; Applications of superconductors.

COURSE OUTCOMES:

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

- Familiarise with the basic principles of Physics and its significance in engineering systems and technological advancements.
- Apply the theories of Physics in the field of Engineering and Technology.
- Exposed to the different branches of Physics and their field of applications in engineering.
- Understand the modern developments in Physics and to utilized them in technological developments.
- Develop the scientific attitudes and to correlate the concepts of Physics to core programmes

TEXT BOOKS:

1. Physics for Engineers- M.R.Seenivasan- New Age Publishers 1996 Edition.
2. Beiser A, Concepts of Modern Physics, McGraw Hill India Ltd.
3. Brijlal and Subramanyam, A Text Book of Optics, S.Chand & Co.
4. Mehta V K, Principles of Electronics, S.Chand & Co.
5. Rajendran V and Marikani A, Physics I, Tata McGraw Hill Co Ltd.

REFERENCE BOOKS:

1. Aruldhas G, Engineering Physics, PHI Ltd.
2. Bhattacharya and Tandon, Engineering Physics, Oxford India.
3. Dominic and Nahari, A Text Book of Engineering Physics, Owl Books Publishers
4. Hecht E, Optics, PearsonEducation.
5. Mehta N, Applied Physics for Engineers, PHILtd.

6. Palais J. C, Fiber Optic Communications, Pearson Education.
7. Pandey B. K and 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 and Rewal A, Engineering Physics, Wiley India Pvt Ltd.
11. Sears and 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 (p) publishers 2000 Edition.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)
20% - 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.

GROUP C

GS19 100	ENGINEERING GRAPHICS	3-0-2-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- Graphics is the language of engineers and hence make the student capable of conceiving shape and geometry of various objects and to effectively communicate their design ideas through drawings and sketches as per standards.
- Enable students to prepare & understand engineering drawings.

SYLLABUS:

Module I: (8 Hours)

Engineering Graphics – introduction - Drawing instruments and their use – lines, Lettering and dimensioning – Scales- Familiarization with Standard Code of practice for general engineering drawing. Theory of projections - Projections of points in different quadrants.

Module II: (16 Hours)

a) 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.

b) 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: (16 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, Tetrahedron, 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, Tetrahedron, Cone and Cylinder).

Module IV: (15 hours)

a) Development of surfaces of solids - Method of parallel line & radial line developments - 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 and combination of them.

Module V: (10 hours)

a) Introduction to perspective projections – Classification of perspective views - Visual ray and vanishing point 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, washers and screws -Locking arrangements of nuts - Bolted and screwed joints - Foundation bolts.

c) Introduction to Computer Aided Drafting (CAD) - Preparation of engineering drawings by using any software capable of drafting and modelling - Creation of simple figures like polygon and general multiline figures only.

(Module V, Part C: For internal work assessment only, not for University Examination)

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 they will be able to make orthographic projections of any object.
- Draw the sectional view of the solids.
- Make developments of surfaces & solids.
- Draw the perspective projections of objects and prepare CAD drawings.

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 and 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)*

PART A

Q 1. Two questions (a) and (b) of 20 marks each from module II, one from module II (a) and one from module II(b), with choice to answer any one.
Q 2. 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 3. 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.

PART B

Q 4. Three Questions (a), (b) and (c) of 20 marks each from module III & V, one from module III(b), one from module V(a) and one from module V(b), with choice to answer any two.

EM19 100	ENGINEERING MECHANICS	3-2-0-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To acquaint with 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.

SYLLABUS:

Module I: (16 Hours)

Introduction to engineering mechanics - units - dimensions - vector and scalar quantities - laws of mechanics - elements of vector algebra - important vector quantities - equivalent force systems – translation of a force to a parallel position - resultant of a force system - simplest resultant of special force systems - distributed force systems - equations of equilibrium - free body diagrams - free bodies involving interior sections - general equations of equilibrium - problems of equilibrium - static indeterminacy. (Both vector and scalar formulations are to be introduced to solve problems).

Module II: (12 Hours)

Friction – laws of friction – simple contact friction problems. Introduction to structural mechanics - trusses - analysis of simple trusses - method of sections – method of joints.

Module III: (12 Hours)

First moment and centroid– theorems of Pappus-Guldinus - 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).

Moment of inertia of a rigid body and lamina (derivation of MI for cylinder, rod and sphere).

Module IV: (15 hours)

Dynamics: Rectangular and Cylindrical co-ordinate system - Combined motion of rotation and translation – Concept of instantaneous center – Motion of connecting rod of piston and crank of a reciprocating pump- Rectilinear translation – Newton's second law – D'Alembert's Principle– Application to 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 the students will be able to

- Gain knowledge on basic concepts of Engineering Mechanics.
- Apply the theory of mechanics in practical level.
- Get 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.
2. Timoshenko, S & Young D. H, Engineering Mechanics, McGraw Hill.

REFERENCE BOOKS:

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

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)
20% - 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.

GROUP D

ME19 100	CONCEPTS OF MECHANICAL ENGINEERING	2-1-0-2

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To introduce different disciplines of Mechanical Engineering.
- To kindle interest in Mechanical Engineering.
- To impart Basic Mechanical Engineering principles.

SYLLABUS:

Module I: (8 Hours)

Thermodynamics: Nature & scope of thermodynamics and basic concepts; Thermodynamic processes: isobaric, isochoric, isothermal, adiabatic and polytropic: workdone and P-V diagrams; Laws of Thermodynamics, entropy, enthalpy; Ideal and real gas equations; Analysis of Carnot cycle, Otto cycle , Diesel cycle and Dual cycle; Efficiency of these cycles.

Module II: (8 Hours)

Thermal Engineering: Historical development of steam engine, steam turbines, gas turbines.

Engines: major components and their functions (Description only); Working principle of two stroke and four stroke I.C. Engines (Diesel and Petrol), applications, comparison; MPFI, GDI & CRDI Engines. Power Transmission Devices: Belts and belt drives; Chain drive; Rope drive; Gears and gear trains; friction clutch (cone and single plate), brakes (types and applications only).

Module III: (8 Hours)

Refrigeration: History & scope of refrigeration; applications of refrigeration; Food preservation, refrigerated storage; applications in chemical and process industries: vapour compression and absorption refrigeration systems, COP, Study of household refrigerator, Energy Efficiency Rating, Refrigerants and their impact on environment.

Hydraulic turbines: Pelton, Francis and Kaplan turbines (applications only).Pumps: Introduction, classification, reciprocating and centrifugal (brief description and working only).

Module IV: (8 hours)

Sources of Energy & power generation: Introduction, Classification: Non-renewable energy; Fossil fuels – solid, liquid and gaseous; Calorific value. Renewable Energy; Hydroelectric, solar, wind, biomass, biogas, ocean thermal, tidal, wave and geothermal energy.

Power Plants: Introduction; Layout and working of Diesel, Nuclear, Thermal and Hydel power plants.

Module V: (7 hours)

Manufacturing Engineering & Materials: Machine Tools (Basic elements, Working principle and types of operations) Lathe, Drilling Machine, Shaper, planer, Slotter, Milling Machine, Grinding machine, Introduction to NC and CNC machines.
Engineering materials: classification, properties; Alloys and their Applications.
Manufacturing process: Introduction, elementary ideas of rolling and extrusion.
Machining operations: turning, shaping, milling and drilling.

COURSE OUTCOMES:

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

- Analyse thermodynamic cycles and calculate its efficiency
- Illustrate the working and features of IC Engines and power transmission devices.
- Explain the basic principles of Refrigeration and describe the working of hydraulic machines
- Acquire knowledge about various energy sources and describe the layout and working of various Power Plants
- Describe the basic manufacturing, metal joining and machining processes

TEXT BOOKS:

1. Balachandran, Basic Mechanical Engineering, Owl Books.
2. Benjamin J., Basic Mechanical Engineering, Pentex Books.
3. Clifford M., Simmons K. and Shipway P., An Introduction to Mechanical Engineering Part I – CRC Press.
4. Pravin Kumar, Basic Mechanical Engineering, pearson publications
5. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd. Mumbai.
6. Sawhney G. S., Fundamentals of Mechanical Engineering, PHI.

REFERENCE BOOKS:

1. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi.
2. Gill, Smith and Zuirys, Fundamentals of IC Engines, Oxford and IBH publishing company Pvt. Ltd. New Delhi. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi.
3. Nag P. K., Basic and Applied Thermodynamics, Tata McGraw-Hill.
4. V Ganeshan, Internal combustion engines, Mc-Graw-Hill.
5. R K Rajput, Thermal Engineering, Laxmi Publications, 2010
6. R K Bansal, A Text Book of Fluid mechanics and hydraulic machines, Laxmi Publications.
7. P C Sharma, Production Technology, S Chand publications

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)
20% - 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.

GROUP E

EE19 101	BASICS OF ELECTRICAL ENGINEERING	2-1-0-2

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To impart a basic knowledge in Electrical Engineering with an understanding of fundamental concepts.

SYLLABUS:

Module I: (7 Hours)

Elementary concepts of electric circuits: Kirchhoff's laws, constant voltage and current sources-Problems; Formation of network equations by mesh current and node voltage methods: matrix representation, solution of network equations by matrix methods- problems; star-delta conversion (resistive networks only-derivation is not needed) -problems.

Module II: (7 Hours)

Magnetic Circuits: MMF, field strength, flux density, reluctance (definition only); comparison between 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 induced and dynamically induced emf - self inductance and mutual inductance, coefficient of coupling.

Module III: (10 Hours)

Alternating Current fundamentals: Generation of alternating voltages-waveforms, frequency, period, average, RMS values and form factor of periodic waveform (pure sinusoidal)- numerical problems.
AC Circuits: Phasor representation of alternating quantities-rectangular and polar representation, Analysis of simple AC circuits: concept of impedance, power and power factor in ac circuits-active, reactive and apparent power solution of RL, RC and RLC series circuits-numerical problems.
Three phase systems: Generation of three phase voltages advantages of three phase systems, star and delta connection (balanced only), relation between line and phase voltages, line and phase currents three phase power measurement by two wattmeter method (derivation is not required)- numerical problems.

Module IV: (8 hours)
Electric Machines: DC Generator and Motor: Construction, working principle,Back EMF.
Types of motor: shunt, series, compound (short and long), principle of operation of dc motor, applications, numerical problems (voltage - current relations only).
Transformer: Construction of single phase and three phase.
Transformers (core type only): EMF equation and related numerical problems.

Losses and efficiency of transformer for full load– numerical problems (no equivalent circuit).

Module V: (7 hours)

AC Motors: Three phase induction motor-squirrel cage and slip ring induction motor working principle- synchronous speed, slip and related numerical problems (No equivalent circuit).
Power Systems: block diagram of power system, generation of power.
Block schematic representation of generating stations- hydroelectric, thermal and nuclear power plants.
Renewable energy sources: solar, wind, tidal, geo thermal (block diagram & working only).

COURSE OUTCOMES:

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

- Apply fundamental concepts and basic circuit laws to solve simple DC electric circuits.
- Understand and analyse basic magnetic circuits.
- Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state.
- Study the working principles of electrical machines.
- Get an idea about various schemes of electric power generation.

TEXT BOOKS:

1. Bhattacharya S. K., Basic Electrical & Electronics Engineering, Pearson.
2. Bird J., Electrical Circuit Theory and Technology, Routledge, Taylor & Francis Group.
3. Del Toro V., Electrical Engineering Fundamentals, Prentice Hall of India.
4. Hayt W. H., Kemmerly J. E., and Durbin, S. M., Engineering Circuit Analysis, Tata McGraw Hill.
5. Hughes, Electrical and Electronic Technology, Pearson Education.
6. Mehta V.K. and Mehta R., Basic Electrical Engineering, S. Chand Publishing.
7. Parker and Smith, Problems in Electrical Engineering, CBS Publishers and Distributors.
8. Sudhakar and Syam Mohan, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill.
9. Suresh Kumar K. S, Electric Circuits and Networks, Pearson Education.

REFERENCE BOOKS:

1. D.P Kothari and I.J Nagrath, :Basic electrical Engineering”, Tata McGraw Hill, 2010.
2. D.C Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
3. L.S. Bobrow : Fundamentals of Electrical Engineering, Oxford University Press, 2011.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)
20% - 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.

EC19 101	BASICS OF ELECTRONICS ENGINEERING	2-1-0-2

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- 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.
- To give basic ideas about various communication systems (no analysis required in this subject).

SYLLABUS:

Module I: (7 Hours)

Passive components: Resistors: concepts of fixed & variable resistors, Carbon composition type resistors, metal film resistors, wire wound resistors, construction, power rating & tolerance.
Capacitors: different types, construction of mica and ceramic capacitors (disc & tubular), colorcode, electrolytic (Teflon) capacitors.
Inductors: construction of single layer, multilayer and variable inductors, principle of low power transformers.
Electro mechanical components: relays and contactors.

Module II: (7 Hours)

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, PN Junction diode, Principle of operation, V-I characteristics, principle of working of Zener diode, Photo diode, LED and Solar cell. Bipolar Junction Transistors, PNP and NPN structures, Principle of operation, input and output characteristics of common emitter configuration (NPN only).

Module III: (9 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.

Module IV: (7 hours)

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

Module V: (9 hours)

Radio Communication: modulation, principle of AM & FM, block diagrams of transmitters, waveforms, band width, principle of AM & FM demodulation, comparison of AM & FM, principle of super heterodyne receiver, block diagram.

Mobile communication: basic principles of cellular communications, concepts of cells, frequency reuse.

Optical communication: block diagram of the optical communication system, principle of light transmission through fiber, advantages of optical communication systems.

COURSE OUTCOMES:

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

- List the basic electronic components such as passive and electro mechanical components.
- Illustrate the basic concept of different types of diodes and transistors.
- Develop simple circuits using diodes and transistors.
- Analyze simple circuits on operational amplifiers and digital gates.
- Explain about the basic communication systems.

TEXT BOOKS:

1. Bell D. A., Electronic Devices and Circuits, Oxford University Press.
2. Tomasy W., Advanced Electronic Communication system, PHI Publishers.

REFERENCE BOOKS:

1. Boylested R. L. and Nashelsky L., Electronic Devices and Circuit Theory, Pearson Education.
2. Frenzel L. E., Principles of Electronic Communication Systems, McGraw Hill.
3. Kennedy G. and Davis B., Electronic Communication Systems, McGraw Hill.
4. Rajendra Prasad, Fundamentals of Electronic Engineering, Cengage Learning.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

CE19 101	BASICS OF CIVIL ENGINEERING	2-1-0-2

PRE-REQUISITE: 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 give a broad perspective to the students to identify the oldest branch of engineering providing basic infrastructure for development.

SYLLABUS:

Module I: Scope of Civil Engineering. (8 Hours)

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: selection of site for buildings, structural components of a residential building and their functions.

Module II: Building Planning. (8 Hours)

Introduction to planning of residential buildings: site plan, orientation of a building, open space requirements, position of doors and windows, size of rooms.; Introduction to the various building area terms: computation of plinth area / built up area; floor area / carpet area- for a simple single storeyed building; setting out of a building.
Building drawing: plan, section and elevation of a single room building with RCC roof (sketching in the paper/note book only is expected).

Module III: Introduction to Surveying. (8 Hours)

Surveying: objects, classification, principles; Brief description of the following instruments: (i) chain and accessories (ii) Dumpy level (iii) Theodolite. Use of levelling instrument for determining reduced levels of various stations: simple problems on leveling, use of theodolite for measuring horizontal angles (only brief description is required). Modern tools of surveying and mapping: total station, global positioning system, remote sensing and geographic information system.

Module IV: Civil Engineering Materials & Building Construction. (8 hours)

Brief description of Engineering properties and applications of the construction materials: bricks, stones, sand, cement, concrete, steel, timber, modern materials (Study on laboratory tests & detailed manufacturing processes of materials are not required).
Cement mortar and cement concrete: properties and applications: reinforced cement concrete fundamentals (only brief description is required).

Module V: Building Construction. (7 hours)

Foundations: types of foundations (sketches only), bearing capacity and settlement (definition only), functions of foundations, requirement of good foundations.
Stone and brick masonry construction: bonds used in general constructions, elevation and plan (one brick thick walls only).
Geometric, structural, and functional features of roads, bridges and dams.

COURSE OUTCOMES:

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

- Get an overview of surveying, building planning, water resources and transportation engineering.
- 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, techniques for water conservation, to prepare layouts of different buildings.
- Understand the Surveying with advanced instruments like remote sensing, GIS and GPS.
- Understand the property, use, advantages & disadvantages of different materials used in construction.

TEXT BOOKS:

1. Surveying Vol. I, II by Dr. B.C. Punamia.
2. Building planning, designing and scheduling by Gurcharan Singh.
3. Building Construction.,Rangwala, S. C. and Dalal, K. B.,Charotar Publishing house.
4. Basic Civil Engineering., S.S Bhavikatti., New Age International Pvt.Ltd,Publishers.

REFERENCE BOOKS:

1. Surveying Vol. I, II by Dr. B.C. Punamia.
2. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni.
3. Surveying Theory and Practice (Seventh Edition) by James M. Anderson, Edward M. Mikhail.
4. Remote sensing and Image interpretation by T.M Lillesand, R.W Kiefer. And J.W Chipman 5th edition.
5. Building Science and Planning by S.V.Doedhar.
6. Principles of Town planning by Keeble Lewis.
7. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House.
8. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)
20% - 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.

GROUP F

ES19 100	ENVIRONMENTAL SCIENCE	2-0-1-0

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- 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.

SYLLABUS:

Module I: Resources (9 Hours)

The multidisciplinary nature of environmental science: definition scope and importance, need for public awareness.
Natural resources: renewable and non-renewable resources; natural-associated problems.
Forest resources: use and over-exploitation; deforestation: case studies- timber extraction, mining, dams and their effects on forests and tribal people.
Water resources: use and over utilization of surface and ground water; floods, drought, and conflicts over water; dams (benefits and problems).
Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources- case studies.
Food resources: world food problems, changes caused by agriculture over grazing-, effects of modern agriculture fertilizer, pesticide problems, water logging, and salinity- case studies.
Energy resources: growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources.
Land resources: land as a resource, land degradation, man-induced landslides (soil erosion and desertification).

Module II: Ecosystems (8 Hours)

Concept of an ecosystem: structure and function of an ecosystem; producers, consumers and decomposers; Energy flow in the ecosystem: food chains and food webs, ecological pyramids, ecological succession.
Different Ecosystems: introduction, types, characteristics, features, structure; Function of the ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystem (ponds, streams, lakes, rivers, ocean and estuaries).

Module III: Biodiversity (8 Hours)

Introduction: definition, genetic, species and ecosystem diversity; Biogeographical classification of India.
Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, national, and local level; India as mega-diversity nation; Hot spot of biodiversity.

Threats to biodiversity: habitat loss, poaching of wild life, and man-wild life conflicts; Endangered and endemic species of India; Conservation of biodiversity (In-situ and Ex- situ conservation of biodiversity).

Module IV: Environmental Pollution. (7 hours)

Definition, causes, effects and control measures of air pollution; Water pollution; Soil pollution; Marine pollution; Noise pollution; Thermal pollution; Nuclear hazards.
Solid waste management: causes, effects and control measures of urban and industrial wastes.
Waste management: role of an individual in prevention of pollution, pollution case studies.
Disaster management: floods, earth-quake, cyclone and landslides.

Module V: Environment and Sustainable Development. (7 hours)

Sustainable use of natural resources; Conversion of renewable energy resources into other forms; Problems related to energy and energy auditing- case studies.
Water conservation: rain water harvesting and watershed management- case studies. Climate change: global warming, acid rain and ozone layer depletion- case studies. Nuclear accidents and holocaust- case studies.
Waste land reclamation: consumerism and waste products: reduce, reuse and recycle concept of products; Value education.

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

REFERENCE BOOKS:

1. Raghavan Nambiar, K Text book 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)*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

DE19 200	CONCEPT BASED ENGINEERING	2-0-1-0

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To excite the student on creative design and its significance.
- To make student aware of the processes involved in the design.
- To make the student understand the interesting interaction of various segments of humanities, science and engineering in the evolution of a design.
- To get an exposure as how to engineer a design.

SYLLABUS:

Module I: (8 Hours)

Introduction: example of different kinds of designs and designers, design problems; Definition of design; engineering design and research: importance, role of science, engineering and technology in design, design constraints, design functions, design means and design form, functional and strength designs. Design form, function and strength; initiation of creative designs; initiating the thinking process for designing a product of daily use. need identification; problem statement; market survey- customer requirements; design attributes and objectives; ideation; brain storming approaches; arriving at solutions; Closing on to the Design needs.

Module II: (8 Hours)

Product life cycle: morphology of design, introduction to system design process, stage models, design process- different stages in design and their significance; define problem, concept generation and evaluation, detailed design process, defining the design space; analogies, quality function deployment: meeting what the customer wants; evaluation and choosing of a design.

Module III: (8 Hours)

Design for X; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. design communication; realization of the concept into a configuration, drawing and model. design for function and strength. design detailing- material selection, design visualization- solid modeling; detailed 2D drawings.

Module IV: (8 hours)

Prototyping- rapid prototyping; testing and evaluation of design; design modifications; freezing the design; cost analysis. Engineering the design from prototype to product. planning; scheduling; supply chains; inventory; handling; manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design. List out the standards organizations. Prepare a list of standard items used in any engineering specialization.

Module V: (7 hours)

Product centred and user centred design. Product centred attributes and user centred attributes, bringing the two closer. Example: smart phone. Aesthetics and ergonomics. value engineering, concurrent engineering, reverse engineering in design; culture based design; architectural designs; motifs and cultural background; tradition and design; design as a marketing tool; intellectual property rights, trade secret; patent; copy-right; trademarks; product liability.

COURSE OUTCOMES:

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

- Initiate process and component elements in good and optimal design.
- Design process stages and evaluation of the different steps involved.
- Visualize models by combining all interdisciplinary fields.
- Testing and evaluate the models while considering non engineering attributes.
- Improve product quality by design survey and obtaining the patent for the product.

TEXT BOOKS/REFERENCE BOOKS:

1. Pahl G, and Beitz, W. Engineering Design: A Systematic Approach, 3rd Ed., Springer, 2007.
2. Cross N. Engineering Design Methods: Strategies for Product Design (4th edition), John Wiley and Sons Ltd., Chichester, 2008.
3. Roozenburg N.F.M., Eekels J. Product Design, Fundamentals and Methods, Wiley, Chichester, 1995.
4. James A Senn, Analysis and Design of Information system, McGraw Hill 2003.

Internal Continuous Assessment *(Maximum Marks-100)*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

GROUP G

CH19 100 (P)	ENGINEERING CHEMISTRY LAB	0-0-2-1

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To equip the students with the working knowledge of chemical principles, nature and transformation of materials and their applications.
- To develop analytical capabilities of students so that they can understand the role of chemistry in the field of Engineering and Environmental Sciences.

SYLLABUS:

List of Experiments

(Minimum 9 experiments out of 10)

1. Preparation of urea–formaldehyde and phenol–formaldehyde resin.
2. Estimation of total hardness in a given sample of water using EDTA.
3. Estimation of chloride ions in domestic water.
4. Determination of dissolved oxygen present in a given sample of water.
5. Determination of available chlorine in a sample of bleaching powder.
6. Estimation of copper in a given sample of brass.
7. Estimation of iron in a sample of iron ore.
8. Estimation of iron in Mohr's salt using standard $K_2Cr_2O_7$.
9. Determination of flash point and fire point of an oil.
10. Preparation of buffers and standardization of pH meter.

COURSE OUTCOMES:

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

- Apply and demonstrate the theoretical concepts of Engineering Chemistry.
- Synthesize of polymers like Bakelite and UF resins
- Estimate the amount of hardness, chloride ion and dissolved oxygen in water
- Measure the available chlorine present in bleaching powder
- Determine the amount of metals like iron or copper present in their ores

TEXT BOOK:

1. Dr.Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria and Sons, New Delhi.

REFERENCE BOOK:

1. Vogel, A Text Book of Quantitative Analysis, ELBS, London.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

PH19 100 (P)	ENGINEERING PHYSICS LAB	0-0-2-1

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To impart practical knowledge about some of the phenomena they have studied in the Engineering Physics course.
- To develop the experimental skills of the students.

SYLLABUS:

List of Experiments

(Minimum 10 experiments out of 20)

1. Characteristics of Zener diode.
2. Determination of band gap energy in a semi-conductor.
3. Voltage regulation using Zener diode.
4. Static characteristics of a transistor in common emitter configuration.
5. Characteristics of photodiode.
6. Characteristics of a LED and wavelength of emitted radiation.
7. Draw the aerial and illumination characteristics of a solar cell.
8. Draw the power load and current-voltage characteristics of a solar cell.
9. Wavelength of mercury spectral lines using diffraction grating and spectrometer.
10. Dispersive power using diffraction grating and spectrometer.
11. Diameter of a thin wire or thickness of a thin wire by Air-wedge method.
12. Wavelength of sodium light by Newtons Ring method.
13. Refractive index of given liquid by Newtons Ring method.
14. Specific rotation of cane sugar solution using polarimeter.
15. Wavelength of laser using Grating. Standardise the Grating using sodium light.
16. Resolving power using diffraction grating and spectrometer.
17. To determine the angular divergence of a laser beam.
18. To measure the numerical aperture of an optical fibre.
19. Melde's string apparatus. Measurement of frequency in the transverse and longitudinal mode.
20. Wavelength and velocity of ultrasonic waves using ultrasonic diffractometer.

COURSE OUTCOMES:

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

- Demonstrate the understanding of the fundamental concepts in physics by setting up laboratory equipment safely and efficiently and planning and carrying out experimental procedures.
- Demonstrate the ability to apply knowledge/skills to real world settings by identifying possible sources of error and implementing techniques that enhance precision.
- Demonstrate critical thinking ability through analyzing and interpreting experimental data.
- Demonstrate effective communication skills by reporting verbally and in written language the experimental data, results, and assessment of reliability.
- Demonstrate teamwork skills by working in groups on a laboratory experiment.
- Demonstrate ability to innovate and be creative in a laboratory experiment.

REFERENCE BOOKS:

1. Avadhanulu M. N., Dani A. A. and Pokley P. M., Experiments in Engineering Physics, S. Chand & Co.
2. Gupta S. K., Engineering Physics Practicals, Krishna Prakashan Pvt Ltd.
3. Koser A. A., Practical Engineering Physics, Nakoda Publishers and Printers India Ltd.
4. Rao, B. S. and Krishna, K. V., Engineering Physics Practicals, Laxmi Publications Sasikumar, P. R. Practical Physics, PHI.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

GROUP H

EE19 100 (P)	ELECTRICAL ENGINEERING WORKSHOP	0-0-2-1

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To impart a basic knowledge of electrical circuits, machines and power systems.

SYLLABUS:

List of Experiments

(Minimum 10 experiments out of 10)

1. Familiarization of various types of service mains: wiring installations, accessories and house hold electrical appliances.
2. Methods of earthing: measurement of earth resistance, testing of electrical installations, precautions against and cure from electric shock.
3. Practice of making different joints: britannia, married and T-joints on copper/aluminium.
4. Wiring practice of a circuit to control two lamps by two SPST switches.
5. Wiring practice of a circuit to control one lamp by two SPDT switches.
6. Wiring practice of a circuit to control one fluorescent lamp and one three pin plug socket.
7. Wiring practice of a main switch board consisting of ICDP switch, DB, MCB‘s and ELCB‘s.
8. Familiarization of various parts of electrical motors and wiring of three phase and single phase motor with starter.
9. Familiarization of energy meter and measurement of energy consumption by a single phase load.
10. Familiarization of various electrical and electronic components such as transformers, resistors, AF and RF chokes, capacitors, transistors, diodes, IC‘s and PCB.

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.
- Familiarize with the methods of earthing.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

EC19 100 (P)	ELECTRONICS ENGINEERING WORKSHOP	0-0-2-1

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- The objective of this course is to familiarize the students about electronic components, measuring instruments, bread board assembling, soldering tools and components etc.

SYLLABUS:

List of Experiments

(Minimum 10 experiments out of 11)

1. Familiarization/identification of electronic components.
2. Draw electronic circuit diagram using IEEE standard symbols.
3. Familiarization/application of instruments and equipment: multimeter, power supply, CRO, function generator.
4. Assembling of electronic circuit on general purpose bread board: Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener regulator.
5. Bread board assembling: Common emitter amplifier.
6. Introduction to soldering practice: study of soldering components, solders, tools, heat sink.
7. PCB assembly and testing of full wave rectifier circuit diagram.
8. PCB assembly and testing of inverting amplifier circuit.
9. Familiarization of setting up of a PA system with different microphones, loud speakers, mixer etc.
10. Assembling and dismantling of desktop computer/laptop/mobile phones.
11. Introduction to robotics: familiarization of components (motor, sensors, battery etc.) used in robotics and assembling of simple robotic configurations.

COURSE OUTCOMES:

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

- Identify and test various active and passive components.
- Make use of various testing instruments and commonly used tools.
- Build electronic circuits on breadboard.
- Solder electronic circuits on PCB.

- Identify various subsystems of electronic systems like PA Systems and desktop computers.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

CE19 100 (P)	CIVIL ENGINEERING WORKSHOP	0-0-2-1

PRE-REQUISITE: 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 model making.

SYLLABUS:

List of Experiments

(Minimum 10 experiments out of 10)

1. Setting out of a building: the student should set out a building (single room only) as per the given building plan using tape only.
2. Setting out of a building: the student should set out a building (single room only) as per the given building plan using tape and cross staff.
3. Chain surveying: study of chain and accessories, plotting one side of a building/ five or six points in the field using chain and cross-staff.
4. Horizontal measurements: study of compass, plotting one side of a building/five or six points in the field using compass; Find the area of an irregular polygon set out on the field.
5. Levelling: study of levelling instruments, determination of reduced levels of five or six points in the field.
6. Theodolite: study of theodolite, measuring horizontal angles.
7. Theodolite: study of theodolite, measuring vertical angles.
8. Brick Masonry.
9. Plumbing: demonstration of plumbing fixtures, exercise in joints
10. Model making of simple solids.

COURSE OUTCOMES:

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

- Understand the procedures for construction of several structures.
- Interpret survey data and compute areas and volumes.
- Familiarize with different components, equipment's and technical standards.
- Get an overview of surveying, building planning, plumbing, leveling.
- Understand the basics of civil engineering works.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

ME19 100 (P)	MECHANICAL ENGINEERING WORKSHOP	0-0-2-1

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- 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

1. Carpentry: study of tools and joints, planning, chiseling, marking and sawing practice, different joints, use of power tools.
2. Fitting: study of tools, chipping, filing, cutting, drilling, tapping, male and female joints and stepped joints.
3. Smithy: study of tools, forging of square prism, hexagonal bolt.
4. Foundry: study of tools, sand preparation, moulding practice.
5. Sheet Metal work: study of tools, selection of different gauge sheets, types of joints, trays and containers.
6. Welding: study of tools, different types of joints, practice.

COURSE OUTCOMES:

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

- Obtain knowledge about various tools and operations used in carpentry.
- Perform various fitting operations and basic operations done in a smithy.
- Obtain sound knowledge in sheet metal work.
- Obtain knowledge of welding and metal properties.
- Obtain knowledge about various tools and operations used in Fitting.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

GROUP I

CM19 100	COMMUNICATIVE ENGLISH	2-0-0-0

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To adapt the employability and career requirements of the industry.
- To adapt students with ease to the Industry environment by equipping with communication skills.
- To focus on overall capability in communicating ideas in an effective manner, apart from gaining academic competence.

SYLLABUS:

Module I: (4 Hours)
Communication: definition, communication process; types of communication: formal and informal. Relevance of body language; verbal and non-verbal effective communication; communication breakdown: how to overcome communication barriers.

Module II: (7 Hours)
Listening skills: listening and typing, focused listening, listening and sequencing of sentences, fill in the blanks, listening and answering questions. Reading comprehension: questions and answers, close exercises; Vocabulary building tasks: vocabulary trees, learning words through situations, word formation, roots, prefixes and suffixes, derivatives, synonyms and antonyms, phrasal verbs, homonyms.

Module III: (8 Hours)
Parts of speech with special focuses on nouns & pronouns, verbs, adverbs, adjectives. Subject- verb agreement. Speaking skills: linguistic and phonetics; vowels and Consonants; 44 phonetic symbols, Diphthongs, syllables, phonemes; stress and rhythm in connected speech: intonations and voice modulations, weak forms and strong forms, production of speech sounds in connected speech, shifting the stress for emphasis, relevance of correct pronunciation, face to face conversation of telephonic conversation.

Module IV: (3 hours)
Writing skills: C.V, effective resume, report, memo, business letters, structuring a report and e-mail communication.

Module V: (4 hours)
Developing self-esteem: presentation skills, facing the interview board, group discussions and debating skills; soft skills and time management; Psychometrics and stress management; emotional quotient.

COURSE OUTCOMES:

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

- Not only understand the process and nature of communication but also recognize the barriers to effective communication and learn to eradicate them.
- Attain and enhance competence in the four modes of learning: writing, speaking, reading and listening, and are able to recognize the meaning of new words based on contextual comprehension.
- Heighten their awareness of correct usage of English grammar in writing and sounds in speaking.
- Write official correspondences i.e., is reports, memos, letters, and e-mails and also prepare impressive curriculum vitae and resumes.
- Improve their self-esteem and also captivate to give effective presentations in a professional and facing interview boards confidently.

REFERENCE BOOKS:

1. Meenakshi Raman and Sangeeta Sharma., Technical Communication- Principles and Practice, Oxford University press.
2. R C Bhatia, Business Communication, Ane Books Pvt. Ltd, 2009.
3. Sunita Mishra and C Muralikrishna, Communication Skills for Engineers, Pearson Education.
4. Jovan van Emden and Lucinda Becker, Effective Communication for Arts and Humanities Students, Palgrave macmillam, 2009.
5. Sanjay Kumar and Pushpalata , Communication skills, Oxford University Press, 2011.
6. Practical English Usage. Michael Swan. OUP. 1995.
7. Remedial English Grammar. F.T. Wood. Macmillan, 2007.
8. On Writing Well. William Zinsser. Harper Resource Book. 2001.
9. Study Writing. Liz Hamp- Lyons and Ben Heasly. Cambridge University Press. 2006.
10. Communication Skills. Sanjay Kumar and PushpLata. Oxford.
11. T M Farhathullah, Communication Skills for Technical Students, Orient Longman, Hyderabad.

Internal Continuous Assessment *(Maximum Marks-100)*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

LL19 200	LANGUAGE LAB	0-0-2-0

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To enhance the linguistic skill of the students, keeping in view of the necessity of imparting employability skills of engineering graduates
- To provide with a software platform which has functions like Listen- Respond-Intercommunicate-Monitor- Teacher call etc.
- To focus on the students overall ability in using English as a tool for communication.
- To overcome the inhibition factor while using English and equip them to adapt themselves to the industry environment with ease and confidence, bringing about a sort of transformation in each student.

LAB SESSIONS:

1. Sessions on introduction to Linguistics and Phonetics: speech sounds and phonetic symbols; Syllables and phonemes.
2. Training to develop sharp listening skills: focused listening with emotional content; Relevance of correct pronunciation.
3. Sessions beginning with two minutes Oral Presentation on topics of their choice; Role plays: students take on roles and engage in dialogues/ conversations.
4. The art of effective communication: effective presentation skills; presentation tools, voice modulations, word accent, rhythm and intonation; audience analysis.
5. Vocabulary building tasks: fun games in English.
6. Relevance of body language, how to face an interview board; mock interviews; group discussions with special focus on a candidate's etiquette; debates and the art of exhibiting the interpersonal skills; public speaking.
7. Soft-skills; Emotional quotient; Training sessions; Stress Management.

COURSE OUTCOMES:

- It brings about a consistent accent and articulacy in the pronunciation through the familiarity of phonetics.
- Advance the capability to listening English conversations
- Enhance their verbal communication skills through free speeches, role plays, activities, and interactions.
- Better understanding of nuances of English language through audio- visual experience and speaking skills with clarity and confidence which in turn enhances their employability skills. It brings about a consistent accent and intelligibility in the pronunciation of English by providing an opportunity for practice in speaking for all the students.
- Capable of identifying the meaning of novel words based on contextual comprehension.

- Equip the students to face the interview board with confidence, making them aware of the nuisances and methodology involved in this area; help them to actively participate in debates and group discussions and face the interview confidently.
- Prepared for creating effective presentations in front of different clusters.

SUGGESTED SOFTWARE:

1. Cambridge Advanced Learners' English Dictionary with CD.
2. The Rosetta Stone English Library.
3. Clarity Pronunciation Power.
4. Mastering English in Vocabulary, Grammar, Spellings, Composition.
5. Dorling Kindersley series of Grammar, Punctuation, Composition etc.
6. Language in Use, Foundation Books Pvt Ltd with CD.
7. Learning to Speak English - 4 CDs.
8. Microsoft Encarta with CD.
9. Murphy's English Grammar, Cambridge with CD.

REFERENCE BOOKS:

1. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. English Pronouncing Dictionary Daniel Jones Current Edition with CD.
3. Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
4. A Practical course in English Pronunciation, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.

Internal Continuous Assessment *(Maximum Marks-100)*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

EN19 301	ENGINEERING MATHEMATICS III	3-1-0-4

PRE-REQUISITE: Calculus and Linear Algebra

COURSE OBJECTIVES:

- To provide a quick overview of the concepts and results in complex analysis that may be useful in engineering.
- To introduce the concepts of linear algebra and Fourier transform which are wealth of ideas and results with wide area of application.

SYLLABUS:

Module I: Linear Algebra – (Proofs not required) (11 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 II: Fourier Transforms (11 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.

Module III: Laplace Transforms (10 hours)

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

Module IV: Series Solutions of Differential Equations (10 hours)

Power series method for solving ordinary differential equations – Frobenius method for solving ordinary differential equations – Bessel's equation – Bessel functions – Relation between Bessel functions.

Module V: 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 ; F1(x,p) = F2(y,q) ; Clairaut's form, z = px + qy + F(p,q) ; Legrange's form, Pp + Qq =R- Classification of Linear PDE's – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables.

COURSE OUTCOMES:

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

- Develop the essential tool of linear algebra in a comprehensive manner.
- Use tools for Fourier Transforms.
- Use tools for Laplace transforms and apply it in solution of differential equations.
- Acquire the knowledge of power series for learning advanced Engineering Mathematics.
- Use mathematical tools for the solution of Partial differential equations that models physical processes.

TEXT BOOKS:

1. Bernaed Kolman, David R Hill, Introductory Linear Algebra, An Applied First Course, Pearson Education, 8th Ed, 2004.
2. Erwin Kreysig, Advanced Engineering Mathematics 9th Edition, John Wiley & Sons, 2006.
3. P.Ramesh Babu, R.Anandanatarajan, Signals and Systems, Scitech Publications (India) Pvt.ltd, 4th Edition, 2011.
4. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition.

REFERENCE BOOKS:

1. N.P.Bali, Manish Goyal, Text Book of Engineering Mathematics, Laxmi Publications, Reprint 2010.
2. Wylie C.R, L.C. Barrett, Advanced Engineering Mathematics, McGraw Hill, 5th Ed, 1982.
3. S.J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)
20% - 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.

ME19 302	FLUID MECHANICS	3-1-0-4

PRE-REQUISITE: 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

SYLLABUS:

Module I: (12 hours)

Introduction-Characteristics of fluids - Distinction between fluids and solids-properties of fluids-density, specific gravity, specific weight, specific volume, capillarity, surface tension, compressibility, bulk modulus, vapor pressure, viscosity-Newton's law of viscosity-types of fluids.

Fluid statics: pressure-Pascal's law- variation of pressure in a static fluid- absolute and gauge pressure- measurement of pressure using manometers- hydrostatic force on plane and curved surfaces-buoyancy and flotation-stability of submerged and floating bodies-metacentric height.

Module II: (10 hours)

Kinematics of fluid flow: Eulerian and Lagrangian methods-classification of fluid flow-steady and unsteady flow, uniform and non-uniform flow, 1D,2D,3D dimensional flow, laminar and turbulent flow, rotational and irrotational flow graphical description of flow pattern-stream lines, path lines, streak lines, stream tubes.- Discharge-continuity equation-velocity and acceleration in fluid flow-Deformation of fluid Elements-circulation and vorticity-velocity Potential function- stream function- equipotential lines- flow Net-uses of flow net-Vortex motion- free and forced vortex.

Module III: (10 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-venturimeter, orifice meter, pitot tube, orifices and mouthpieces, notches and weirs-Momentum Principle- Steady flow momentum equation-momentum and energy correction factors.

Module IV: (10 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, 2011.
2. S. K. Som, G Biswas, Fluid Mechanics and Fluid Machines, Tata McGraw Hill, 2008.
3. D.S. Kumar, Fluid Mechanics & Fluid Power Engg, S Kataria &Sons, 2013.
4. R. K. Bansal, Fluid Mechanics & Hydraulic Machines, Laxmi Publications, 10th Ed, 2008.
5. R.K.Rajput, Fluid Mechanics & Hydraulic Machines, S Chand & Co, 6th Ed, 2016.

REFERENCE BOOKS:

1. Cengel, Fluid Mechanics, McGraw Hill Education India, 2014.
2. Dr J. F. Douglas, Dr J. M. Gasoriek, Prof John Swaffield, Fluid Mechanics, Pearson Education, 2005.
3. White F.M., Fluid Mechanics, Tata McGraw Hill, 2008.
4. Philip J. Pritchard, Fox & McDonald's Introduction to Fluid Mechanics, Wiley, 2015.
5. F.M. Streeter, Fluid Mechanics, Tata McGraw Hill, 2008.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 303	MECHANICS OF SOLIDS	3-1-0-4

PRE-REQUISITE: 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.

SYLLABUS:

Module I: (11 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.

Module II: (11 hours)
Torsion-Torsion of circular solid and hollow shafts-Power transmission – strain energy in shear and torsion-close coiled and open coiled helical springs.
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-shear force and bending moment diagrams for statically determinate plane frames. 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: (10 hours)
Stress on inclined planes for axial and biaxial stress fields-principal stresses. Transformation of stress and strains: Plane state of stress - equations of transformation - principal planes and stresses. Mohr's circles of stress – plane state of strain – analogy between stress and strain transformation – strain rosettes
Compound stresses: Combined axial, flexural and shear loads – eccentric loading under tension/compression - combined bending and twisting loads (Concepts Only)
Theory of columns. Axial loading of short strut-long columns - Euler's formula – Rankine's formula- Secant formula-eccentric loading – direct bending stress.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse the 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 and design components and structural members subjected to tension, compression, torsion, bending and combined loads using fundamental concepts of stress, strain, elastic and inelastic behavior.
- Conduct themselves in a professional manner and with regard to their responsibilities to society; especially with regard to design of mechanisms and prevention of failure.

TEXT BOOKS:

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

Internal Continuous Assessment *(Maximum Marks-50)*
70% - Tests (minimum 2)
20% - 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.

ME19 304	METALLURGY AND MATERIAL SCIENCE	3-1-0-4

PRE-REQUISITE: Engineering Physics and Engineering Chemistry

COURSE OBJECTIVES:

- To provide an understanding of basic structure and crystal arrangement of materials, imperfections in solids and instruments used in metallography
- To understand the mechanisms of solidification, phase diagram, deformation and strengthening of metals for effective designing in various engineering applications.
- To enable students for selecting appropriate materials for design and construction of various engineering applications by analysing properties and micro structure of materials.

SYLLABUS:

Module I: (12 hours)
Introduction - classification, properties and selection of engineering materials, 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: (12 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, Fe-Fe_3C phase diagram – features and reactions.

Module III: (10 hours)
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. Alloy steels Ferrous alloys; plain carbon steels, alloy steels, tool steels, stainless steels, effect of alloying elements on properties of steels, cast irons-classification, Non-ferrous alloys: Al and Al alloys, Cu and Cu alloys, Mg and Mg alloys, Zn and Zn alloys-major types.

Module IV: (10 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.
Failure of metals – Fracture – Ductile, Brittle fracture, Fatigue – S - N curve, Factures effecting fatigue life – Creep – Generalized creep behavior.

Module V: (8 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.
- Discuss the concept of phase & phase diagram, Construction and identification of phase diagrams and reactions and Correlate the micro structure with properties and performance of metals
- Analyse the effect of heat treatment in steel and explain the features and classifications of various ferrous and non-ferrous alloys.
- Explain 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 & sons, 2010.
2. V. Raghavan, Materials Science and Engineering,5thEdition, Prentice Hall India, 2007
3. Dr. V. D Kodgire and Dr. S V Kodgire, Material Science and Metallurgy, 36th Edition, Everest publishing house, 2015.
4. Jose S & Mathew E. V., Metallurgy and Material science, Pentagon education services, 1st edition 2011.

REFERENCE BOOKS:

1. Avner S. H., Introduction to Physical Metallurgy, McGraw Hill, 2nd Ed, 2017.
2. G Dieter, Mechanical Metallurgy, McGraw Hill, 3rd Ed, 2017.
3. Van Vlack, Material Science and Engineering, Pearson Education, 6th Ed, 2002.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% -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

ME19 305	ELECTRICAL TECHNOLOGY	3-1-0-3

PRE-REQUISITE: Basics of Electrical Engineering

COURSE OBJECTIVES:

- To understand the concept operation, performance and characteristics of electrical machines.
- To familiarize generation distribution and transmission of electrical power.
- To study an overview of power electronic devices & electric drives.

SYLLABUS:

Module I: (10 hours)

DC machines: Basic principle of operation of DC Generator, construction, emf equation, types of generators, armature reaction and commutation, characteristics, losses and efficiency.
DC Motor: working principle, Concepts of motoring and generating action, Torque equation, Types of motors, characteristics, starting, speed control, losses and efficiency, brake test, Swinburne´s test, applications.

Module II: (10 hours)

Transformers: Working principles and elementary theory of an ideal transformer, Constructional features of single phase transformer, emf equation, turns ratio, vector diagram, equivalent circuit, impedance transformation, transformer losses, flux leakage, efficiency, open circuit and short circuit test, load test.
Auto transformer - working principle and saving copper, basic idea of current transformer and potential transformer, distribution and power transformer, applications, standard rating, IS specifications.

Module III: (12 hours)

Review of Alternators: Distribution and chording factor, EMF equation, 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.
Review of 3-phase induction motor: Slip, rotor frequency, equivalent circuit, phasor diagram, torque equation, Torque – Slip Characteristics, losses and efficiency, No-Load and Blocked Rotor tests. Starting of 3-Phase Induction Motors: Direct-On-Line, Autotransformer, Star-Delta and Rotor Resistance Starting.

Module IV: (10 hours)

Electrical Drives: Advantages of Electric Drives, parts of electrical drives, fundamental Torque Equation, Four Quadrant Operation, Components of Load Torque – Friction, Windage & 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 & Frequency Control (Block Diagram Approach).

Module V: (10 hours)

Generation Transmission and Distribution of electrical energy: Different methods of power generation thermal, hydro-electric, nuclear, diesel, gas turbine stations(general idea only) electrical equipment in power stations, concept of bus bar, load dispatching, methods of transmission, transmission lines, overhead lines and insulators, corona and skin effect of DC a AC distribution, substation (elementary idea only).
Power semiconductor devices: General overview about SCR, Power MOSFET & IGBT. Static Characteristics of SCR, Uninterruptable power supply (Block diagram description).

COURSE OUTCOMES:

On completion of this course the 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 induction motors and alternators.
- Learn about the generation, transmission, and distribution of electrical energy.
- Know about various power semiconductor devices.

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)*
70% - Tests (minimum 2)
20% - 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

EN19 306	LIFE SKILLS AND ETHICS FOR ENGINEERS	2-0-2-0

PRE-REQUISITE: Nil

LIFE SKILLS

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

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.
- To inculcate critical thinking process.
- To prepare them on problem solving skills.
- To provide symbolic, verbal, and graphical interpretations of statements in a problem description.
- To understand team dynamics & effectiveness.
- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values, Loyalty and also to learn to appreciate the rights of others.
- 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 & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Steps in problem solving, Problem Solving Techniques: Problem Solving through Six Thinking Hats, Mind Mapping and 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 thinking, getting acquainted, Clarifying expectations.

Group Problem Solving, Achieving Group Consensus.

Group Dynamics techniques, Group vs Team, Team Dynamics, Teams for enhancing productivity, Building & Managing Successful Virtual Teams. Managing Team Performance & Managing Conflict in Teams.

Working Together in Teams, Team Decision-Making, Team Culture & Power, Team Leader Development.

Module IV: (10 hours)

Morals, Values and Ethics, Integrity: Work Ethic, Service Learning, Civic Virtue, Respect for Others, Living Peacefully.

Caring, Sharing, Honesty, Courage, Valuing Time, Cooperation, Commitment, Empathy, Self-Confidence, Character Spirituality, Senses of 'Engineering Ethics', variety of moral issued, 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, Balanced outlook on.

The challenger case study, Multinational corporations, 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, style, followers, crises.

Growing as a leader, turnaround 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:

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

- Define and Identify different life skills required in personal and professional life, which will enable them to make effective presentations and face group discussions.
- Critically think on a particular problem and Solve problems.
- Work in Group & Teams
- Handle Engineering Ethics and Human Values.
- Become an effective leader.

***TEXT BOOKS*:**

1. 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”, First Edition; Oxford Publishers, 2011.
3. Kalyana; (2015) “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd.
4. Larry James (2016); “The First Book of Life Skills”; First Edition; Embassy Books.
5. Shalini Verma (2014); “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand (G/L) & Company
6. John C. Maxwell (2014); “The 5 Levels of Leadership”, Centre Street, A division of Hachette Book Group Inc.
7. Remesh S., Vishnu R.G., "Life Skills for Engineers", Ridhima Publications, First Edition, 2016

EVALUATION SCHEME

Internal Evaluation

(Conducted by the College)

Total Marks: 100

Part – A

1. Group Discussion – Create groups of about 10 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation is as follows;

(i) Communication Skills – 20 marks (ii) Subject Clarity – 10 marks (iii) Group Dynamics - 10 marks (iv) Behaviors & Mannerisms - 10 marks **(Marks: 50)**

Part – B

2. Presentation Skills – Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation is as follows;

(i) Communication Skills* - 20 marks (ii) Platform Skills** - 20 marks (iii) Subject Clarity/Knowledge - 10 marks **(Marks: 50)**

* Language fluency, auditability, voice modulation, rate of speech, listening, summarizes key learnings etc.

** Postures/Gestures, Smiles/Expressions, Movements, usage of floor area etc.

ME19 307 (P)	COMPUTER ASSISTED MACHINE DRAWING	0-0-3-1

PRE-REQUISITE: Engineering Graphics

COURSE OBJECTIVES:

- To impart the fundamental concepts of machine drawing
- To develop primary knowledge of working drawings.
- 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 0: (6 hours)

Preparation of working drawings with specification using any popular drafting software.

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 BOOKS:

1. N D Bhatt, V M 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.Vargheese, Machine Drawing, VIP Publishers, Thrissur.

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)

Question I:

Answer any one question out of two questions of 25 marks each from (a) and (b) section of module I. ***1x25 marks= 25 marks***

Question II:

Answer any one question out of two questions of 30 marks each from (a) and (b) section of module II. ***1x30 marks= 30 marks***

Question III:

Answer any one question out of two questions of 45 marks each from (a) and (b) section of module III. ***1x45 marks= 45 marks***

ME19 308 (P)	ELECTRICAL TECHNOLOGY LAB	0-0-3-1

PRE-REQUISITE: Basics of Electrical Engineering

COURSE OBJECTIVES:

- To familiarize various electrical measurement equipment's and measurement methods
- To obtain the performance characteristics of dc and ac machines

SYLLABUS:

List of Experiments

(A minimum of 10 experiments must be conducted)

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. Determination of V-I characteristics of linear resistance and incandescent lamp
6. 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.
7. Measurement of L, M & K of i) transformer windings and ii) air core coil.
8. OC & SC tests on 3-phase alternator
    a. Predetermine the voltage regulation at various loads and different power factors by EMF method.
9. Load test on single phase transformer
    a. Determine efficiency and regulation at various loads and unity power factor.
10. OC & SC tests on single phase transformer
    a. Determine equivalent circuit parameters
    b. Predetermine efficiency and regulation at various loads and different power factors.

11. 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

- Understand different types of measuring instruments.
- Obtain the performance characteristics of dc and ac machines.
- Measure power and energy in single phase circuit.
- Measure the power and power factor single phase and three phase circuits.
- Measure the different circuit parameters in an electrical circuit.

REFERENCE BOOKS:

1. 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

EN19 401	ENGINEERING MATHEMATICS IV	3-1-0-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To deal with the methods for collection, classification and analysis of numerical data.
- To describe the characteristics and compute probabilities using both discrete and continuous probability distributions.
- To develop hypothesis testing methodology using test statistics.
- To introduce the tools of differentiation and integration of functions of complex variable that is used in various techniques dealing engineering problems.

SYLLABUS:

Module I: Bivariate Probability Distributions. (10 hours)

Two random variables-Joint probability mass function- Joint probability density function- Marginal probability distributions-Conditional probability distributions-Independence of random variables- Joint distribution function- Bivariate moments-Conditional expectation- Conditional variance.

Module II: Probability Distributions (10 hours)

Random variables - Mean and Variance of probability distributions - Binomial Distribution - Poisson Distribution - Poisson approximation to Binomial distribution – Hyper geometric Distribution – Geometric Distribution - Probability densities - Normal Distribution - Uniform Distribution - Gamma Distribution.

Module III: Sampling Distributions and Testing of Hypothesis (12 hours)

Population and Samples - Sampling Distribution - Sampling distribution of Mean (s known) - Sampling Mean (s known) – Sampling distribution of Mean (unknown) - Sampling distribution of Variance - Interval Distribution – Confidence interval for Mean - Null Hypothesis and Test of Hypothesis - Hypothesis concerning one mean – Hypothesis concerning two means - Estimation of Variances - Hypothesis concerning one variance - Hypothesis concerning two variances - Test of Goodness of fit.

Module IV: 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 V: 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 (Proof not required) – Taylor series (No proof) – Laurent series (No proof) – Singularities – Zeros – Poles – Residues – Evaluation of residues – Cauchy's residue theorem – Evaluation of real definite integrals.

COURSE OUTCOMES:

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

- Acquire the knowledge of basic ideas of joint probability distributions.
- Acquire the knowledge to describe the characteristics and compute probabilities using both discrete and continuous probability distributions.
- Develop the skills of hypothesis testing methodology using test statistics.
- Distinguish to compute the differentials of various complex function in various engineering problems.
- Acquire the mathematical tools of integration of functions of complex variable that are used in various techniques dealing engineering problems.

TEXT BOOKS:

1. Richard A Johnson, C B Gupta, Miller and Freund's Probability and statistics for Engineers, Pearson Education, 2006.
2. Wylie C.R and L.C. Barret, Advanced Engineering Mathematics, McGraw Hill, 6^{th} Ed, 1985.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition

REFERENCE BOOKS:

1. Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
2. N Bali, M Goyal, C Watkins, Advanced Engineering Mathematics, A Computer Approach, 7e, Infinity Science Press, Fire Wall Media.
3. William Hines, Douglas Montgomery, avid Goldman, Connie Borror, Probability and Statistics in Engineering, 4e, John Wiley and Sons, Inc.
4. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists, 3e, Elsevier, Academic Press.
5. H Parthasarathy, Engineering Mathematics, A Project & Problem based approach, Ane Books India.
6. B V Ramana, Higher Engineering Mathematics, McGrawHill.
7. J K Sharma, Business Mathematics, Theory and Applications, Ane Books India.
8. Babu Ram, Engineering Mathematics Vol. II, 2nd edition, Pearson Education.
9. Sastry S.S., Advanced Engineering Mathematics-Vol. I and II, Prentice Hall of India.
10. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw- Hill, 2^{nd} edition.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 402	COMPUTER PROGRAMMING IN C	2-0-2-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To impart the basic concepts of computer and information technology.
- To develop skill in problem solving concepts through learning C programming in practical approach

SYLLABUS:

Module I: (8 hours)

Introduction to Computers and Computer Programming Concept - CPU, Memory, Various input-output devices, Internal representation of data, Program paradigms, Object oriented and procedural oriented programs, Compilers and interpreters, Low level language and high level language, Flow chart and algorithm – Development of flow chart and algorithms for simple problems.

Module II: (10 hours)

Introduction to C language - Basic elements of C- Structure of C program – Data types in C, Preprocessor directives- Header files- Library functions-Operators and expressions – Procedure and order of evaluation – Declaration statements - Input and Output functions. While, do-while and for statements, if, if-else, switch, break, Programming examples.

Module III: (10 hours)

Arrays - Introduction to Arrays-Declaration, Initialization – One dimensional array – Defining and processing arrays - two dimensional and multidimensional arrays – application of arrays - Matrix operations, Sorting and searching.

Strings – Introduction – Declaration – Input and output functions - String handling functions – Array of strings – Programming examples

Module IV: (10 hours)

Functions- Declaring, defining, and calling functions – parameter passing methods – passing arrays to functions -Recursion – Inline functions – Function overloading – Function with default arguments - Programming examples.

Pointers- Concepts, declaration -initialization of pointer variables, call by value and call by reference, simple programming examples.

Module V: (10 hours)

Solution of linear system of equations and curve fitting: Gauss elimination, Gauss-Jordan and Gauss–Seidel methods, Regression and correlation by linear fit and parabolic fit. Numerical problems and preparation of computer programs for the above methods.

COURSE OUTCOMES:

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

- Develop simple applications in C using basic constructs.
- Implement algorithms using efficient c programming techniques.
- Design and implement applications using arrays and strings.
- Analyze problems, identify subtasks and implement them as functions and develop applications using pointers in C.
- Solve system of linear equations and prepare C programs.

TEXT BOOKS:

1. P. Norton, Peter Norton's Introduction to Computers, Tata McGraw Hill, New Delhi, 6^{th} Ed, 2008.
2. E. Balaguruswamy, Programming in ANSI C, 3rd ed., Tata McGraw Hill, New Delhi, 2004.
3. Rajaraman V, Computer basics programming in C, PHI, 2008.
4. Balagurusamy, Numerical Methods 1e McGraw Hill Education, 1999.

***REFERENCE BOOKS*:**

1. B. Gottfried, Programming with C, 2nd ed, Tata McGraw Hill, New Delhi, 2006.
2. B. W. Kernighan, and D. M. Ritchie, the C Programming Language, Prentice Hall of India, New Delhi, 1988.
3. K. N. King. C Programming: A Modern Approach, 2nd ed., W. W. Norton & Company, 2008.
4. S. Kochan, Programming in C, CBS publishers & distributors.
5. M. Meyer, R. Baber, B. Pfaffenberger, Computers in Your Future, 3rd ed., Pearson Education India.
6. Gerald C. F. and P. O. Wheatley, Applied Numerical Analysis, Pearson, 2004.

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test 1 (for Theory)

40% - Test 2 (for Lab, Internal Examination)

10% - Main 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.

ME19 403	THERMODYNAMICS	3-1-0-4

PRE-REQUISITE: Concepts of Mechanical Engineering

COURSE OBJECTIVES:

- To understand basic thermodynamic principles and laws
- To develop the skills to analyze and design thermodynamic systems

SYLLABUS:

Module I: (10 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: (10 hours)

Different forms of energy - Stored energy and transition energy, work and heat, different types of work transfer, pdV work, free expansion, First law of thermodynamics, Joule's experiment, first law applied for a cycle and change of state - internal energy and enthalpy, PMM I, first law applied for open system. Steady flow energy equation and applications. – Filling and Emptying Process, Limitations of the First Law.

Module III: (11 hours)

Second law of thermodynamics - thermal reservoir, heat engine, Kelvin - Plank and Clausius statement, Equivalence of two statements, PMM 2, refrigerator and heat pump, reversibility and irreversibility, Causes of irreversibility, types of irreversibility, Carnot cycle, Carnot's theorem. Entropy, Clausius inequality, Entropy principle and its applications. Available energy, Law of degradation of energy, useful work, dead state, Availability, and irreversibility, Gibb's and Helmholtz function, Second law efficiency, Third law of thermodynamics.

Module IV: (10 hours)

Pure Substances, Phase Transformations, Triple point, properties during change of phase, T-v, p-v and p-T diagram of pure substance, p-v-T surface, Saturation pressure and Temperature, T-h and T-s diagrams, h-s diagrams or Mollier Charts, Dryness Fraction, steam tables. Property calculations using steam tables (simple problems only). 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, Compressibility factor, Law of corresponding state, Compressibility charts (simple problems only).

Module V: (11 hours)

Mixtures of ideal Gases – Mole Fraction, Mass fraction, Gravimetric and volumetric Analysis, 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:

Internal Energy, Enthalpy, specific heats and Entropy, Introduction to real gas mixtures-Kay's rule. 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 & inversion temperature (simple problems only).

COURSE OUTCOMES:

At the end of the course the student 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 fundamentals 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, 4^{th} 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. Richard E. Sonntag, Claus Borgnakke, Gordon J Van Wylen, Fundamentals of Thermodynamics, Sixth edn, John Wiley & Sons, 2002.
2. Yunus Cengel, Michael A Boles, Thermodynamics an Engineering Approach, 8^{th} Ed, McGraw Hill, 2007.
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

STEAM TABLES *PERMITTED FOR REFERENCE IN THE FINAL EXAMINATION:*

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

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% -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.

ME19 404	HYDRAULIC MACHINERY	3-1-0-4

PRE-REQUISITE: Concepts of Mechanical Engineering

COURSE OBJECTIVES:

- To study the operation, performance and characteristics of different types of hydraulic machines.
- To familiarize various theories behind the working of hydraulic machines.

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. Basic equation of energy transfer in rotodynamic machines components of energy transfer-Classification-Axial flow, radial flow, impulse and reaction machines.

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 & series operation- propeller pumps.

Module IV: (11 hours)

Dimensional analysis – Rayleigh's method – Buckingham's Pi theorem – principle of similitude, geometric, kinematic and dynamic similarity – model studies. Non dimensional numbers (Reynolds number, Froude's number, Euler's number, Weber's number and Mach's number)– Principle of similitude – unit speed, unit power, unit quantity, geometric similarity – model laws – effect of specific speed on runner speed, runner size, flow type etc. Cavitation in fluid machines – installations susceptible to cavitation – collapse of bubble theory – Thomas parameter – factors affecting cavitation in pumps and turbines –prevention of cavitation damage.

Module V: (10 hours)

Positive displacement pumps: reciprocating pump, effect of vapour pressure on lifting of liquid – indicator diagram – acceleration head – effect of friction – use of air vessels – work saved – Slip - efficiency – pump characteristics – applications.
Theory & 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 & lift – principle of operation- hydraulic cranes, hydraulic press- Hydraulic symbols (Description only, no problems).

COURSE OUTCOMES:

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

- Discuss the applications of impulse momentum equation
- Acquire knowledge about various turbines.
- Get a vivid idea about rotodynamic pumps.
- Familiarize with different dimensional analysis methods and principle of similitude.
- Acquire knowledge about reciprocating pumps and other simple hydraulic elements.

TEXT BOOKS:

1. Jagdish Lal, Hydraulic Machines, Metropolitan Publishers, 1994.
2. R K Bensal, Fluid mechanics and Hydraulic machines, 10^{th} Ed, 2018.

REFERENCE BOOKS:

1. R.K.Rajput, Fluid Mechanics and Hydraulic Machines, S.Chand & Co., 6^{th} Ed, 2016.
2. Modi & Seth, Hydraulic Machines, Laxmi Publications, New Delhi
3. Stepanoff John A. J, Centrifugal and axial flow pumps, wiley & sons, 1966.
4. Som S K, Biswas G, Introduction to fluid mechanics and fluid machines, TMH.

Internal Continuous Assessment *(Maximum Marks-50)*
70% - Tests (minimum 2)
20% - 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.

ME19 405	MANUFACTURING PROCESS - I	3-1-0-3

PRE-REQUISITE: Concept of Mechanical Engineering and Metallurgy and Material Science

COURSE OBJECTIVES:

- To gain theoretical and practical knowledge in material casting processes and 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, limitations 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 control, testing, cores and core making. Design considerations in casting, gating and Riser - directional solidification in castings

Module II: (10 hours)

Casting Processes: Sand casting, Shell Mold Casting – Ceramic Mold 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 of single crystal components-Casting defect–inspection and testing of castings.

Module III: (11 hours)

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

Module IV: (10 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: (11 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:

Upon completion of the course, the student 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; Seventh edition, 2018
2. P C Sharma, A Textbook of Production Technology, S. Chand Publishing, 2007
3. R K Jain, Production Technology, Khanna Publishers, 2001
4. Amitabha Ghosh, Ashok Kumar Mallick, Manufacturing Science Affiliated East West Press Ltd, New Delhi, 2002.

REFERENCE BOOKS:

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

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

EN19 406	CONSTITUTION OF INDIA	2-0-2-0

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To help the students to concentrate on their day to day discipline.
- To gives the knowledge and strength to face the society and people.

SYLLABUS:

Module I: (8 hours)

Definition of constitution, historical back ground, salient features of the constitution - Preamble of the constitution, union and its territory - Meaning of citizenship, types, termination of citizenship.

Module II: (12 hours)

Definition of state, fundamental rights, general nature, classification, right to equality ,right to freedom , right against exploitation - Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences - Directive principles of state policy, classification of directives, fundamental duties.

Module III: (10 hours)

The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions - The parliament, composition, Rajya sabha, Lok sabha, qualification and disqualification of membership, functions of parliament - Union judiciary, the supreme court, jurisdiction, appeal by special leave.

Module IV: (9 hours)

The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories - The State Legislature, composition, qualification and disqualification of membership, functions - The state judiciary, the high court, jurisdiction, writs jurisdiction.

Module V: (9 hours)

Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission - Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals - Official language, elections, special provisions relating to certain classes, amendment of the Constitution.

COURSE OUTCOMES:

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

- Explain the background of the present constitution of India and features.
- Utilize the fundamental rights and duties.
- Understand the working of the union executive, parliament and judiciary.
- Understand the working of the state executive, legislature and judiciary.
- Utilize the special provisions and statutory institutions.

TEXT BOOKS:

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

***REFERENCE BOOKS*:**

1. Ministry of law and justice, the constitution of India, Govt of India, New Delhi, 2019.
2. JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019
3. MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

Internal Continuous Assessment *(Maximum Marks-100)*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

ME19 407 (P)	MATERIAL TESTING LAB	0-0-3-1

PRE-REQUISITE: Engineering Mechanics

COURSE OBJECTIVES:

- To provide knowledge on the mechanical behaviour of materials.
- To acquaint with the experimental methods to determine the mechanical properties of materials.

SYLLABUS:

List of Experiments

(A minimum of 10 experiments must be conducted)

1. Standard tension test on mild steel using Universal Testing Machine and suitable extensometers.
2. Compression test: Stress-strain characteristics of brittle materials - cast iron.
3. Spring test - open and closed coiled springs - determination of spring stiffness and modulus of rigidity.
4. Determination of modulus of rigidity of wires.
5. Hardness tests - Brinnell hardness, Rockwell hardness (B S C scales), Rockwell superficial hardness (N & T Scales) and Vickers hardness.
6. Impact test - Izod and Charpy.
7. Bending test on wooden beams.
8. Fatigue testing - study of testing machine.
9. Photo elastic method of stress measurements (two dimensional problems).
10. Torsion test on mild steel rod.
11. Shear test on mild steel rod.

COURSE OUTCOMES:

At the end of the course the 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, 3rd Ed, 2017.
2. J W Dally, W.P Railey, Experimental stress analysis, McGraw Hill, 3rd Ed, 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

ME19 408 (P)	PRODUCTION ENGINEERING LAB I	0-0-3-1

PRE-REQUISITE: Concepts of Mechanical Engineering

COURSE OBJECTIVES:

- To acquaint with the basic operations of centre lathe and 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

- Identify and explain the function of the basic components of a machine tool.
- Understand the use of Centre and CNC lathe and their fields of application.
- Program and operate a CNC lathe.
- Operate different machine tools using proper work holders
- Produce different part features to the desired quality.

REFERENCE BOOKS:

1. W. A. J. Chapman, Workshop Technology Part I, ELBS & Edward Arnold Publishers, 1959.
2. J. Anderson, Shop Theory, Tata McGraw Hill, 6th Ed, 1990.
3. S.K. Hajra Choudhury, Workshop Technology Vol II, Media Promoters & Publishers, 2010.
4. R.K. Jain, Production Technology, Khanna Publishers, 1976.
5. R. Quesada, T. Jeyapoovan, Computer Numerical Control, Pearson Education, 2019.

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

EN19 501	ENGINEERING ECONOMICS AND PRINCIPLES OF MANAGEMENT	3-1-0-3

SECTION 1: ENGINEERING ECONOMICS

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To make fundamentally strong base for decision making skills by applying the concepts of economics.
- Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
- Prepare engineering students to analyse profit/revenue data and carry out make economic analysis in the decision making process to justify or reject alternatives/projects.

SYLLABUS:

Module I: (11 hours)

Introduction to Engineering Economics – Technical efficiency, Economic efficiency.
Supply and Demand: Determinants of demand, Law of demand, Determinants of supply, Law of supply, Market equilibrium. Elasticity of demand – Types of elasticity, Factors affecting the price elasticity of demand - Utility analysis, indifference curves, Law of equi-marginal utility, marginal utility theory, Law of diminishing marginal utility -production possibility curve Production concepts-average product-marginal product-law of variable proportions, Isoquant.

Module II: (10 hours)

Value Analysis - Time value of money - Interest formulae and their applications: Single-payment compound amount factor, Single-payment present worth factor, Equal-payment series compound amount factor, Equal-payment series sinking fund factor, Equal-payment series present worth factor, Equal-payment series capital recovery factor, Effective interest rate. Investment criteria: Pay Back Period, Net Present Value, Internal Rate of Return, Benefit-cost ratio.

COURSE OUTCOMES:

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

- Analyse the basic concepts used in engineering economics and apply the basics of economics to take economically sound decisions.
- Understand Time Value of Money and apply suitable cash flow methods for different situations.

TEXT BOOKS:

1. Panneerselvam. R, Engineering Economics, Prentice Hall of India Ltd, 2001.
2. Dwivedi, D.N., "Managerial Economics, 7/E", Vikas Publishing House, 2009.
3. Salvatore D. Managerial Economics: Principles and Worldwide Application: (adapted version). OUP Catalogue, 2012.

***REFERENCE BOOKS*:**

1. Sullivan, W.G, Wicks, M.W., Koelling. C.P., Engineering Economy 15/E, Prentice Hall, New York, 2011.
2. Chan S. Park, Contemporary Engineering Economics‖, Prentice Hall of India, 2002.
3. Prasanna Chandra, Financial Management: Theory & Practice, 8/E, Tata-McGraw Hill, 2011.
4. Rangarajan C. Indian economy: essays on money and finance. UBS Publishers' Distributors; 1999.

Internal Continuous Assessment *(Maximum Marks-20)*

70% - Tests (minimum 2)

20% - 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-40)*

PART A**: Analytical/problem solving SHORT questions **4 x 5 marks= 20 marks

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

PART B**: Analytical/Problem solving DESCRIPTIVE questions **2 x 10 marks= 20 marks

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

SECTION 2: PRINCIPLES OF MANAGEMENT

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To develop ability to analyse and evaluate a management processes and variety of management practices in the contemporary context;
- To understand and apply the basic concepts of functional areas of management like Human resources, Marketing and Finance;
- To be able to evaluate managerial decision making process, project management techniques, developing innovative products and social responsibility ideologies to create sustainable organisations;
- To be able to understand existing managerial practices to create their own innovative management competencies, required for complex global workplace.

SYLLABUS:

Module III: (10 hours)

The management process: managerial skills and roles, evolution of management theory; principles of planning: types of plans, steps in planning; principles of organizing: organizational structures; directing; motivation; controlling; sustainability in management.

Module IV: (11 hours)

Human resource management: human resource planning, performance metrics.

Marketing management: fundamentals of marketing, market segmentation, consumer and industrial markets.

Financial management: Basic principles of: double entry book keeping, financial statements, sources of finance, classification of costs, break-even analysis (Basic concepts only).

Module V: (10 hours)

Managerial decision making process: decision making under certainty, risk and uncertainty; network techniques for project management: critical path method (CPM); Programme Evaluation and Review Technique (PERT): time/cost trade-off in critical path networks (simple problems only).

Entrepreneurial processes: analysis of new ventures/start-ups, creating innovative products/services and business plans, importance of corporate social responsibility

COURSE OUTCOMES:

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

- List out the roles, skills and functions of management.
- Analyse the basic concept of human resources, marketing and financial management in the organizations and integrate the learning in handling these complexities.
- Apply the concept of decision making, network techniques, analysis of new ventures as a part of project management / an organization.

TEXT BOOKS:

1. H. Koontz, and H. Weihrich, Essentials of Management: An International Perspective, 10^{th} Edition. McGraw-Hill, 2015.
2. Ramesh Unnikrishnan, Principles of Management, Educational Publishers and Distributers, 2021.
3. O. P. Khanna, Industrial Engineering and Management, 17^{th} Edition, Dhanpat Rai Publications, 2018.

***REFERENCE BOOKS*:**

1. R. W. Griffin, Management: Principles and Applications. 10^{th} Edition, Cengage Learning, 2008.
2. P. Kotler, K. L. Keller, A. Koshy, and M. Jha, Marketing Management: A South Asian Perspective, 15th ed. Pearson, 2014.
3. M. Y. Khan, and P. K. Jain, Financial Management. 8^{th} Edition Tata-McGraw Hill, 2018.
4. Heinz Weirich, Mark V Cannice and Harold Koontz, Management: a Global, Innovative and Entrepreneurial Perspective, 14th Edition, McGraw Hill Education, 2013.

Internal Continuous Assessment *(Maximum Marks-30)*

70% - Tests (minimum 2)

20% - 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-60)*

PART A**: Analytical/problem solving SHORT questions* ***6 x 5 marks= 30 marks

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

PART B**: Analytical/Problem solving DESCRIPTIVE questions* ***3 x 10 marks= 30 marks

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

Note: Section 1 and Section 2 are to be answered in separate answer books.

Maximum 40 marks and 60 marks for Section 1 and Section 2 respectively.

ME19 502	MANUFACTURING PROCESS II	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To impart fundamental knowledge on theory of machine tools, metal cutting principles, advanced machining processes and press working operations.

SYLLABUS:

Module I: (11 hours)

Metal cutting: cutting variables- mechanics of chip formation- types of chips produced- orthogonal and oblique cutting-velocity relationships- cutting forces-cutting power temperature in cutting –single point and multipoint tools – tool geometry- tool designation – tool wear and tool life- machinability- cutting tool materials-cutting fluids- economics of machining.

Module II: (10 hours)

Machining Process- tool- work motion – Turning –parameters- lathes and lathe operations- material removal rate- cutting force- Milling-parameters – UP milling and Down milling – power- torque-cutting forces- Drilling- drills- material removal rate- cutting forces- Reaming – Broaching- Tapping – Boring – Planning- Shaping- Slotting- Grinding- cylindrical and surface grinding.

Module III: (11 hours)

Advanced Machining Processes: Electrical Discharging Machining EDM – Wire EDM- Electro chemical machining- Laser beam machining – abrasive jet machining- ultrasonic machining- electron beam machining- plasma arc machining – water jet machining.

Module IV: (10 hours)

Press working operations- types of presses – press selection – press working terminology- Forming- principles- cutting forces – dies and punches- clearances- constructional features- simple, compound, combination and progressive dies- strippers- scrap strip layout- Centre of pressure- press tonnage.

Module V: (10 hours)

Drawing – drawing forces- blank holding pressure- bending force – die blank size estimation- forging- forgeability- open and closed die forging- forging force- grain flow- extrusion- explosive forming- electro hydraulic forming- electromagnetic forming – rolling- extrusion.

COURSE OUTCOMES:

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

- Analyze the mechanism of metal cutting.
- Explain the various conventional and Non-conventional machining processes and list their applications.
- Discuss about the important aspects of Press working operations.
- Discuss about the important aspects of forging, extrusion rolling techniques.
- Explain the important aspects of different Forming Techniques.

TEXT BOOKS:

1. Serope Kalpakjian, Steven R Schmid, Manufacturing Engineering & Technology, Pearson, New Delhi, 7th Ed.
2. Sharma P C, A Textbook of Production Engineering, S. Chand & Co, 11th Ed.
3. Jain R K, Production Technology, Khanna Publishers, 2014.

***REFERENCE BOOKS*:**

1. HMT, Production Technology, Tata McGraw Hill Pvt. Ltd, 1998.
2. ASTME, Fundamentals of Tool Design, Prentice Hall of India, 1962.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 503	HEAT AND MASS TRANSFER	3-1-0-4

PRE-REQUISITE: Fluid Mechanics

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 provide useful information concerning the performance and design of simple heat transfer systems.
- To introduce mass transfer.

SYLLABUS:

Module I: (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: (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: (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: (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: (8 hours)

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum – Convective Mass Transfer Correlations.

COURSE OUTCOMES:

Upon completion 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, 3^{rd} Ed, 2011.
2. Sachedeva, Heat and Mass Transfer, New Age International, 5^{th} 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:

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

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 504	MECHANICS OF MACHINERY	3-1-0-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide knowledge on kinematics of selected mechanisms
- To understand the basic concepts of toothed gearing and kinematics of gear trains.
- To understand and to design few linkage mechanisms and cam mechanisms for specified output motions
- To provide knowledge on synthesis of mechanisms

SYLLABUS:

Module I: (10 hours)

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law –Kinematic inversions of four-bar chain, slider crank chains and double slider crank chains – Limit positions –Mechanical advantage – Transmission Angle -Coupler curves – Description of some common Mechanisms – Quick return mechanisms, Straight line generators, Dwell Mechanisms, Ratchets and Escapements, Universal Joint, steering mechanisms.

Module II: (10 hours)

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical and analytical methods – Velocity and acceleration polygons – Velocity analysis using instantaneous centers – Kennedy's theorem- Relative acceleration - Coriolis acceleration- Computer applications in the kinematic analysis of simple mechanisms.

Module III: (11 hours)

Gears – terminology of spur gears – law of Gearing - involute spur gears involutometry - contact ratio - interference - backlash - gear standardization – interchangability - Non-standard gears, centre distance modification, long and short addendum system. – Internal gears - theory and details of bevel, helical and worm gearing

Gear trains - simple and compound gear trains - planetary gear trains – differential - solution of planetary gear train problems - applications

Module IV: (11 hours)

Cams and Followers:- classification of cam and followers - displacement diagrams, velocity and acceleration analysis of SHM, uniform velocity, uniform acceleration, cycloidal motion

Graphical cam profile synthesis, pressure angle, Analysis of tangent cam with roller follower and circular cam with flat follower, Introduction to polynomial cams.

Module V: (10 hours)

Kinematic synthesis (Planar Mechanisms) - Tasks of kinematic synthesis – Type, Number and dimensional synthesis – Precision points - Graphical synthesis for four link mechanism Function generator – 2 position and 3 position synthesis – Overlay Method - Analytical synthesis techniques – Freudenstein's equation – complex number methods - one case study in synthesis of mechanism

COURSE OUTCOMES:

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

- Summarize the kinematic elements and inversions of various planar mechanisms.
- Analyze displacement, velocity and acceleration of planar linkages.
- Explain the basic concepts of toothed gearing and analyze kinematics of gear trains.
- Analyze the kinematics and profile synthesis of disc cam, tangent cam and arc cam.
- Prescribe dimensional synthesis of four bar linkages using precision points.

TEXT BOOKS:

1. Ballaney P. L., Theory of Machines and Mechanisms, Khanna Publishers, 2005.
2. S. S. Rattan, Theory of Machines, Tata McGraw Hill, 2009.

***REFERENCE BOOKS*:**

1. C. E. Wilson, P. Sadler, Kinematics and Dynamics of Machinery, Pearson Ed., 2005.
2. D. H. Myskza, Machines and Mechanisms Applied Kinematic Analysis, Pearson Education, 2013.
3. G. Erdman, G. N. Sandor, Mechanism Design: Analysis and synthesis Vol I & II, Prentice Hall of India, 1984.
4. Ghosh, A. K. Malik, Theory of Mechanisms and Machines, Affiliated East West Press, 1988.
5. J. E. Shigley, J. J. Uicker, Theory of Machines and Mechanisms, McGraw Hill, 2010.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 505	METROLOGY AND INSTRUMENTATION	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide the fundamental concepts and principles of metrology and instrumentation.
- To demonstrate the system of limits, fits and tolerance and design of limit gauges
- To illustrate the various methods of measurement of physical and mechanical quantities.

SYLLABUS:

Module I: (10 hours)

Concept of measurement: -Introduction to Metrology, Need of Measurements, Mechanical measurement – direct comparison and indirect comparison, the generalized measurement system, types of input quantities, measurement standards, Terminologies in Measurement-Precision, accuracy, sensitivity, calibration, etc.,

Errors in measurement, classifications of errors, introduction to uncertainty – propagating uncertainty, Kline and Mc-lintock approach, zero first and second order instruments

Basic standards of length- Line standard, End standards, Wavelength standard; Various Shop floor standards.

Linear Measurement – Slip gauges, wringing, grades; Surface plate; Dial indicators; Height gauges and Vernier calipers

Angular Measurement – Bevel protractor; Sine Bar, principle and use of sine bar, sine centre; Angle gauges, Sprit level; Auto collimator; Angle Dekkor; Clinometers

Module II: (10 hours)

Types of assembly – Making to suit, selective assembly, Systems of limits and fits - Types of fits; Standard systems of limits and fits; Tolerance, allowance and deviation (as per BIS), Hole basis system and Shaft basis system, Simple problems on tolerance and allowance, shaft and hole system.

Limit Gauges – GO and NO GO gauges; types of limit gauges. Gauge design - Taylor's principle of gauging; Gauge tolerance, disposition of gauge tolerance and wear allowance

Optical Measuring Instruments: Benefits of using light waves as standards; Monochromatic light; Principle of Interference, Interference band using optical flat, application in surface measurement

Interferometers – NPL flatness interferometer, Pitter-NPL gauge interferometer.

Module III: (10 hours)

Measurement of surface roughness - Primary texture, secondary texture and the lay, Quantitative terms used to describe surface roughness

Methods of measuring surface finish - The Talysurf instrument, Tomlinson surface meter, Tracer type profilograph.

Measurement of screw thread profiles – Screw thread terminology, Measurement of major diameter, Measurement of minor or root diameter, Measurement of pitch; Measurement of effective diameter with two wire method and three wire method.
Gear tooth measurement – measurement of gear profile, tooth thickness, tooth spacing, pitch circle diameter, Parkinson's gear tester
The coordinate measuring machine construction, operation and programming, Machine vision, image acquisition and digitization, image processing and analysis.

Module IV: (11 hours)

Sensors and Transducers – loading error, Classification of transducers: variable resistance transducers, sliding contact devices – variable inductance elements, self-inductance and mutual inductance elements, differential transformer, construction and characteristics – rotary differential transformer, variable reluctance transducer, capacitance transducers. active and passive transducers, piezo electric transducers, photoelectric sensors, Hall effect transducers, resistance wire strain gages – types, theory of metallic strain gauges, calibration of strain gauges, application of strain gauges-load cells.

Module V: (11 hours)

Measurement of flow – need for flow metering, rotameter - theory and constructional details, magnetic flow meters, hotwire anemometers, drag force flow meter, Measurement of low pressure - the Mc Leod Gauge, thermal conductivity gauges
Measurement of temperature - Liquid-in-glass thermometers, Bimetallic strip thermometer, Pressure thermometers, Thermocouples – Principle, Laws for Thermocouples, Thermocouple materials and construction, measurement of Thermocouple EMF, Resistance Temperature Detectors (RTD); Resistance thermometer circuits, Thermistors, Pyrometers

COURSE OUTCOMES:

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

- Illustrate the fundamentals of mechanical measurements, errors in measurements and the working of linear and angular measuring instruments.
- Demonstrate the fundamentals of Limits, Fits and Tolerance, Gauge design and applications of interferometers.
- Measure different parameters of screw thread and compute surface roughness using different techniques.
- Illustrate the working principle of different types of transducers and measurement of strain
- Elucidate the working principle of flow and temperature measurement instruments

TEXT BOOKS:

1. Thomas G. Beckwith, John H. L., Roy D. M., Mechanical Measurements, 6/E, Pearson Prentice Hall, 2007.
2. Ernest O. Doebelin, Measurement Systems Application and Design, McGraw-Hill Publishing Company, 4th Ed, 1990.
3. Jain R.K., Engineering Metrology, Khanna Publishers, Delhi, 21st Ed, 1984.
4. Holman J.P., Experimental Methods for Engineers, McGraw Hill Co, 8th Ed, 2011.

***REFERENCE BOOKS*:**

1. ASME, Hand book of Industrial Metrology,1998
2. Hume K. J., Engineering Metrology, Macdonald & Co. Ltd.,1990
3. Sharp K.W.B., Practical Engineering Metrology, Sir Isaac Pitman & Sons Ltd.,1958
4. Jain R.K., Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1995.
5. Rangan, Mani and Sharma, Instrumentation, Tata McGraw-Hill Publications.
6. B C Nakra, K K Choudhary, Instrumentation, measurement & analysis, TMH.
7. Kastushiko Ogatta, Modern control systems, McGraw-Hill, 5th Ed, 2019.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 506(A)	ENERGY ENGINEERING MANAGEMENT	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide knowledge on energy conservation and management.
- To impart the basics of renewable energy technology

SYLLABUS:

Module I: (10 hours)

Energy and environment: Introduction – fossil fuel reserves – world energy consumption – greenhouse effect – global warming. Energy Economics – Simple payback period, IRR, NPV, Life cycle costing.

Module II: (10 hours)

Renewable energy sources. Overview of solar, wind, tidal, geothermal, nuclear energy sources, – insulated pipe work systems. - Environmental aspects utilization – energy prices – energy policies.

Module III: (11 hours)

Energy conservation: Industrial energy use – energy surveying and auditing – energy index – energy cost –energy conservation in engineering and process industry, in thermal systems, in buildings and nonconventional energy resources schemes.

Module IV: (10 hours)

Energy technologies: Fluidized bed combustion – fluidized bed boilers – waste heat recovery systems – heat pump and refrigerators – Cogeneration concept, options (steam/gas turbines/diesel engine based)

Module V: (11 hours)

Energy management: Energy management principles – energy resources management – energy management information systems – computerized energy management. Costing techniques – cost optimization – optimal target investment schedule.

COURSE OUTCOMES:

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

- Analyse the overview of world energy scenario and energy economics.
- Learn about the renewable energy sources.
- Describe the importance of energy management and energy auditing.
- Explain the basics of renewable energy technology.
- Discuss various energy management techniques.

TEXT BOOKS:

1. W. R. Murphy, G. Mc Kay, Energy Management, Butterworths, London, 1981.

***REFERENCE BOOKS*:**

1. Callaghn, Design and Management for energy conservation, Pergamon Press, Oxford, 1981.
2. D. Merick, Energy - Present and Future Options, vol 1 and 2, John Wiley and Sons, 1981.
3. N. A. Chaigier, Energy Consumption and Environment, McGraw Hill.
4. Sukhatme, S. P., Nayak, J. K., Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, 3rd Ed, 2009.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 506(B)	ADVANCED MECHANICS OF SOLIDS	3-1-0-3

PRE-REQUISITE: Mechanics of Solids

COURSE OBJECTIVES:

- To impart concepts of stress and strain analysis in a solid.
- To study the methodologies in theory of elasticity at a basic level.
- To acquaint with the solution of advanced bending problems.
- To acquaint with energy methods to solve structural problems.

SYLLABUS:

Module I: (10 hours)

Introduction to stress analysis in elastic solids - stress at a point – stress tensor – stress components in rectangular and polar coordinate systems - Cauchy's equations – stress transformation – principal stresses and planes - hydrostatic and deviatoric stress components, octahedral shear stress - equations of equilibrium.

Displacement field – engineering strain - strain tensor (basics only) – analogy between stress and strain tensors - strain-displacement relations (small-strain only) – compatibility conditions

Module II: (10 hours)

Constitutive equations – generalized Hooke's law – equations for linear elastic isotropic solids - relation among elastic constants – Boundary conditions – St. Venant's principle for end effects – uniqueness theorem.

2-D problems in elasticity - Plane stress and plane strain problems – stress compatibility equation - Airy's stress function and equation – polynomial method of solution – solution for bending of a cantilever with an end load.

Module III: (10 hours)

Equations in polar coordinates (2D) – equilibrium equation, strain displacement relations, Airy's equation, stress function and stress components (only short derivations for examination).

Application of stress function to lame's problem and stress concentration problem of a small hole in a large plate (only stress distribution).

Axisymmetric problems – governing equations – application to thick cylinders, rotating discs.

Module IV: (11 hours)

Unsymmetrical bending of straight beams (problems having c/s with one axis of symmetry only) – curved beams (rectangular c/s only) - shear center of thin walled open sections (c/s with one axis of symmetry only)

Energy Methods: Strain energy of deformation - strain energy of a bar subjected to axial force, shear force, bending moment and torque, Maxwell reciprocal theorem – Castigliano's first and second theorems – virtual work principle – minimum potential energy theorem - complementary energy theorem.

Module V: (11 hours)

Torsion of non-circular bars: Saint Venant's theory - solutions for circular and elliptical cross- sections.

Prandtl's method - solutions for circular and elliptical cross-sections - membrane analogy - approximate solution methods for non-circular shafts.

Torsion of thin walled tubes, thin rectangular sections, rolled sections and multiply connected sections

COURSE OUTCOMES:

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

- Apply concepts of stress and strain analyses in solids.
- Derive constitutive relationships and solve 2D problems in elasticity
- Develop the governing equations in cylindrical coordinate to solve Axisymmetric problems
- Apply the concepts of energy methods in solving structural problems
- Analyze the torsion of circular/non circular bars using classical method

TEXT BOOKS:

1. L. S. Sreenath, Advanced Mechanics of Solids, McGraw Hill, 3rd Ed, 2010.
2. S. M. A. Kazimi, Solid Mechanics, McGraw Hill, 1st revised Ed, 2017.

***REFERENCE BOOKS*:**

1. S. P. Timoshenko, J. N. Goodier, Theory of elasticity, McGraw Hill, Indian Ed, 2017.
2. J. P. Den Hartog, Advance Strength of Materials, McGraw Hill, 1952.
3. C. K. Wang, Applied Elasticity, McGraw Hill, 1963.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 506(C)	DATA ANALYTICS FOR ENGINEERS	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To introduce the concepts of data modeling techniques using Machine Learning for Data Analytics to increase the job opportunities of B. Tech. students in corporate sectors as well as government agencies, and they can take up their project work in this field of emerging technologies.
- To learn about state-of-the-art Machine Learning techniques and how to apply them in real life problems.

SYLLABUS:

Module I: Data Definitions and Analysis Techniques (10 hours)

Elements, Variables, and Data categorization - Levels of Measurement - Data management and indexing - Introduction to statistical learning and R-Programming.

Module II: Descriptive Statistics (10 hours)

Measures of central tendency - Measures of location of dispersions - Practice and analysis with R.

Module III: Basic analysis techniques (12 hours)

Statistical hypothesis generation and testing - Chi-Square test - t-Test - Analysis of variance - Correlation analysis - Maximum likelihood test - Practice and analysis with R.

Module IV: Data analysis techniques (10 hours)

Regression analysis - Classification techniques - Clustering - Association rules analysis - Practice and analysis with R.

Module V: Case studies and projects (10 hours)

Understanding business scenarios - Feature engineering and visualization - Scalable and parallel computing with Hadoop and Map-Reduce - Sensitivity Analysis.

COURSE OUTCOMES:

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

- Prepare data for data analysis and statistical methods are applied on data for data Analysis and Data Mining.
- Describe the Data definition and also learn R –Analysis /programming Language.
- Measure the Data descriptive statistics & also measure the location of dispersions and analysis with R –programming
- Solve the problems by using the basic analysis techniques

- Analyse the business scenario & study about the sensitivity Analysis.

TEXT BOOKS:

1. Montgomery, Douglas C., and George C. Runger. Applied Statistics and Probability for Engineers. John Wiley & Sons, 2010.
2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, 2009.
3. Kevin P. Murphy, Machine Learning: A probabilistic perspective, The MIT Press, 2012.
4. Chris Bishop, Pattern Recognition and Machine Learning, Springer, 2010.
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer, 2017.

***REFERENCE BOOKS*:**

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence: A Managerial Perspective on Analytics, Pearson Education, 4^{th} Ed, 2019.
2. Thomas W Miller, Modelling Techniques in Predictive Analytics, Pearson, 2018.
3. A. C. Muller, S. Guido, Introduction to Machine Learning with Python, O'Reilly, 2016.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 506(D)	COMPUTATIONAL METHODS IN ENGINEERING	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide constructive methods for obtaining solutions of problems in a numerical form.
- To introduce a tool of numerical techniques dealing with various engineering problems.
- To impart the knowledge of various numerical methods in applying in engineering fields.
- To understand about the method of applying numerical techniques with the help of computers for solving complex problems.
- To impart the knowledge of various numerical methods in solving differential equations.

SYLLABUS:

Module I: Solutions of Algebraic and transcendental equations (10 hours)

Errors in numerical calculations: Sources of errors, significant digits and numerical instability - numerical solution of polynomial and transcendental equations - bisection method - method of false postilion - Newton- Raphson method - fixed-point iteration - rate of convergence of these methods - iteration based on second degree equation - the Muller's method - Graeffe's root squaring method for polynomial equations - Bairstow method for quadratic factors in the case of polynomial equations

Module II: Solutions of system of linear algebraic equations (10 hours)

Direct methods - Gauss Elimination and Gauss-Jordan methods - Crout's reduction method - iterative methods - Jacobi's iteration - Gauss- Seidal iteration - relaxation method - convergence analysis - solution of system of nonlinear equations by Newton- Raphson method - power method for the determination of Eigen values – convergence of power method.

Module III: Interpolation (10 hours)

Polynomial interpolation: Lagrange's interpolation polynomial - Divided difference - Newton's divided difference interpolation polynomial- error in interpolations - finite differences operators - Gregory- Newton forward and backward interpolations -Gauss forward and backward interpolation formula- Stirling's interpolation formula - interpolation with a cubic spline

Module IV: Numerical differentiation and Numerical integration (10 hours)

Numerical differentiation: differential formula in the case of equally spaced points - numerical integration: Quadrature formulae - trapezoidal rule-Simpson's rules – Weddle's rule-Gaussian integration - error of integration formulae.

Module V: Numerical solution of ordinary differential equations (12 hours)

Taylor series method – Picard's method-Euler and modified Euler methods - Range - Kutta methods (2nd order and 4th order only) - multistep methods - Milne's predictor-corrector formulae - Adam-Bash forth and Adam - Moulton formula- finite difference methods for solving two dimensional Laplace's equation for a rectangular region - finite difference method solving heat equation and wave equation with given initial and boundary conditions.

COURSE OUTCOMES:

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

- Acquire the knowledge of applying numerical methods in engineering problems.
- Develop the skill in using numerical techniques as a tool.
- Acquire and develop constructive methods in solving the complex problems in numerical way.
- Apply numerical techniques for solving complex problems.
- Develop the skill of solving differential equations using various numerical methods.

TEXT BOOKS:

1. Chapra and Canale, Numerical methods for Engineers, McGraw Hill, 7th Ed, 2015.
2. James B. Scarborough, Numerical Mathematical Analysis, Oxford and IBH Publishing, 2008.

REFERENCE BOOKS**:**

1. Froberg, Introduction to numerical analysis, Addison Wesley Educational Publishers Inc., 1970.
2. Kandaswamy, P Thilakavthy, K Gunavathy, Numerical Analysis, S Chand and Co, 1999.
3. F B Hildebrand, introduction to Numerical Analysis, Dover Publications Inc., 2nd Ed, 2003
4. Dr.B.S. Grewal, Numerical Methods in engineering and science, Khanna Publications, 3rd Ed, 1996.
5. S. Sankara Rao, Numerical Methods of Scientists and Engineer, 3rd Ed., PHI, 2007.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 506(E)	MARKETING MANAGEMENT	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To introduce the concept of market and marketing.
- To give idea about launching a new product.
- To introduce the various marketing strategies.

SYLLABUS:

Module I: (11 hours)

Introduction to marketing : Defining marketing for the twenty first century, marketing – scope, tasks, concept of market and marketing, company orientations towards the market place – production , product, selling, marketing, customer and societal marketing concepts. Marketing environment: Controllable factors – factors directed by top management – uncontrollable factors – demographic, economic, competition, political- legal and social – cultural environment

Module II: (10 hours)

Market Oriented strategic planning – key areas, organizational levels, corporate and division strategic planning – corporate mission, strategic business units, The Boston consulting group approach, The general electric model, Planning new businesses – Growth – Intensive, integrative, diversification, Marketing mix – variables, marketing mix strategy.

Module III: (10 hours)

Market-segmentation – levels, patterns, procedure, effectiveness. Market targeting – Evaluation, target market selection. Marketing research – Need and scope – Marketing research process– research objectives, developing research plan, collecting information, analysis and findings.

Module IV: (10 hours)

Consumer behaviour – factors influencing consumer behaviour – Cultural, social personal, psychological factors. Defining customer value and satisfaction. Product life cycles – marketing strategies for different stages of product life cycle. Marketing communications – process – steps in developing effective communications – Identification of the target audience, determination of communication objectives.

Module V: (11 hours)

Designing the message, select the communication channels, establishing the total marketing communications budget – Deciding on the marketing communications mix – promotional tools an over view – advertising, sales promotion, public relations and publicity, sales force and direct marketing- developing and managing an advertising program – setting objectives, deciding budget, choosing message – sales promotion tools – purpose, major decisions. New trends in marketing– Brand management– significance of branding to consumer and firms.

COURSE OUTCOMES:

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

- State the role and functions of marketing within a range of organizations.
- Describe key marketing concepts, theories and techniques for analyzing a variety of marketing situations.
- Identify and demonstrate the dynamic nature of the environment in which marketing decisions are taken.
- Synthesize ideas into a marketing plan.
- Demonstrate analytical skills in identification and resolution of problems pertaining to marketing management.

TEXT BOOKS:

1. P. Kotler, Marketing Management, 14th Edition – Pearson Education (India) Pvt. Ltd, New Delhi, 2013.
2. T N Chabra and S K Grover: Marketing management, Dhanpat Rai, 2007.
3. Majumdar R., Marketing Research, Text, Applications and Case Studies, New Age International (P), 1991.
4. Ramaswamy V.S., Namkumari S, Marketing Management: Planning, Implementation and Control, Macmillan India Limited, 2002.

***REFERENCE BOOKS*:**

1. V. S. Ramaswamy, S. Namkumari, Marketing Management, McMillan India Ltd, New Delhi, 1997
2. Saxena, Marketing Management, 2nd Edition, Tata McGraw Hill, 2002
3. Stanton W.J., Etzel M.J., Walker B.J, Fundamentals of Marketing, McGraw Hill International Edition, 1994.
4. Baines P., Fill C., Page K., Marketing, Oxford University Press, 2013
5. Robert, Marketing Research, Prentice Hall of India, 1999.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 506(F)	ADVANCED METAL JOINING TECHNIQUES	3-1-0-3

PRE-REQUISITE: Manufacturing Process I

COURSE OBJECTIVES:

- To provide basic understanding of the advanced metal joining processes and their importance

SYLLABUS:

Module I: (12 hours)

Welding processes - Heat source models- Weld pool modelling and characteristics- Heat affected zone characteristics- Molten metal transfer in welding- Distortions- Residual stresses and their measurement methods.

Module II: (12 hours)

Laser Beam Welding, Physics of Lasers, Types of Lasers, Process Parameters, Applications and Limitations. Electron Beam Welding- Basic phenomena, Guns, Weld Environment, Welding in Different Degrees of Vacuum, Equipment and Safety, Joint Design, Applications

Plasma arc welding: Plasma Arc Welding- theory and Principles, Transferred arc and Non-Transferred arc Techniques, Equipment and Tooling, Joint Design Advantages, Disadvantages, Materials and Applications

Module III: (10 hours)

Explosive Welding- theory, Parameters, Weld Quality, Equipment and Tooling, Advantages and Limitations, Joint Design, Materials and Applications, Adhesive Bonding- theory, Physical Characteristics, Metal Adhesive, Equipment, Design, Economics of Process, Materials and Applications.

Module IV: (10 hours)

Ultrasonic welding-basic principle, Process Characteristics and Applications, Vacuum brazing- Theory, Mechanisms and parameters, Equipment and Tooling, Stop-Off and Parting Agents, Advantages, Limitations, Economics Materials and Applications.

Module V: (8 hours)

Friction Stir Welding - Metal flow phenomena, tools, process variables and applications, Friction Stir Processing- Process, Application

Welding of dissimilar metals- Joining of ferrous and non-ferrous metals, Polymers- Advances in brazing and soldering.

COURSE OUTCOMES:

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

- Explain the physical concepts in metal joining process.
- Discuss about the various imperfections in metal joining process and methods to quantify them.
- Familiarize, understand and explain the fundamental concepts of various advanced metal joining techniques and list their applications.
- Select suitable joining process for robust and efficient design of mechanical systems.
- Become an efficient designer by familiarizing the various codes and conducts to be followed in metal joining process.

TEXT BOOKS:

1. Parmar R.S., “Welding Processes and Technology”, Khanna Publishers, Delhi, 1998.

***REFERENCE BOOKS*:**

1. Rossi, Welding Engineering, McGraw Hill, 1954.
2. Schwartz M.M., “Metals Joining Manual”, McGraw-Hill Inc., 1979.
3. ASM Metals Hand Book “Welding and Brazing”, Vol. 6, ASM, Ohio, 1988.
4. Welding Engineers Hand Book- ASHE Vol . I, II, III and IV.
5. Sindo Kou ,Welding Metallurgy, Wiley-Blackwell, Second Edition, 2002
6. Udin et al., Welding for Engineers, John Wiley & Sons, New York, 1967.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 507 (P)	FLUID MECHANICS AND MACHINERY LAB	0-0-3-1

PRE-REQUISITE: Fluid Mechanics

COURSE OBJECTIVES:

- To demonstrate the applications of theories of basic fluid mechanics and hydraulic machines and to provide a more intuitive and physical understanding of the theory.
- To equip the students to carry out independent experiments, and to train them to analyse, report and infer the results.

SYLLABUS:

Study

- Study of plumbing tools and pipe fittings
- Study of gauges - pressure gauge, vacuum gauge, manometers.
- Study of discharge measuring instruments
- Study of valves - stop valve, gate valve and foot valve.
- Study of pumps – Centrifugal, Reciprocating, Rotary, Jet.
- Study of Turbines - Impulse and reaction types.
- Study of Hydraulic ram, accumulator etc.

List of experiments

(A minimum of 10 experiments must be conducted)

1. Determination of coefficient of discharge and calibration of Orifice meter
2. Determination of coefficient of discharge and calibration of Venturimeter.
3. Determination of coefficient of discharge and calibration of Notches
4. Determination of Chezy's constant and Darcy's coefficient on pipe friction apparatus
5. Determination of Minor losses in various pipe fittings
6. Determination of hydraulic coefficients of orifices
7. Determination of metacentric height and radius of gyration of floating bodies.
8. Experiments on hydraulic ram
9. Reynolds experiment
10. Bernoulli's experiment
11. Performance test on positive displacement pumps
12. Performance test on centrifugal pumps

13. Performance test on gear pump
14. Performance test on Impulse turbines
15. Performance test on reaction turbines (Francis and Kaplan Turbines)
16. Speed variation test on Impulse turbine
17. Impact of jets

COURSE OUTCOMES:

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

- Discuss the physical basis of Bernoulli's equation, and apply it in flow measurement (orifice, Nozzle and Venturi meter), and to a variety of problems.
- Determine the efficiency and plot the characteristic curves of different types of pumps and turbines.
- Determine various losses in pipe flows.
- Comprehend the metacentric height.
- Predict the coefficient of discharge for flow through pipes.

***REFERENCE BOOKS*:**

1. H. Shames, Fluid Mechanics, McGraw Hill, 2^{nd} revised Ed, 1992.
2. J. P. Holman, Experimental methods for Engineers, McGraw Hill, 8^{th} Ed, 2011.
3. D. G. Shepherd, Principles of Turbo Machinery, McMillan, 1971.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Laboratory practical, Record and Viva voce

30% - Test/s

10% - Attendance and Regularity in the class

University Examination Pattern *(Maximum Marks-100)*

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

20% - Viva voce

10% - Fair record

ME19 508 (P)	PRODUCTION ENGINEERING LAB II	0-0-3-1

PRE-REQUISITE: Concepts of mechanical engineering

COURSE OBJECTIVES:

- To impart knowledge on the fundamental concepts and principles of metrology.
- To acquaint with the basic machine tools.
- To impart training on shaper, slotting, milling and grinding machines.

SYLLABUS:

Introduction

- Limits, fits and tolerances.
- Shaping machine – slotting machine – horizontal milling machine – surface, centreless and cylindrical grinding.
- Spindle drives – milling cutter – indexing head.
- Simple, compound, differential and angular indexing.

Study of Machines

- Shaper
- Planer
- Slotting machine
- Drilling machine
- Milling machine
- Grinding machine
- Power saws

List of exercises

1. Exercises on shaper and slotting machines – cube with V-groove, slot and guide ways.
2. Exercise on milling machine – spur gear and helical gear milling by simple and differential indexing, surface milling, slot and key way milling.
3. Exercise on grinding and tool grinding.

COURSE OUTCOMES:

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

- Discuss the principle and purpose of various reciprocating machines and to perform various operations.
- Discuss the use of drilling machine and to perform the various operations.
- Analyse the construction and configuration of milling machine and to perform the various operations.
- Discuss the principle and applications of grinding and super finishing operations and to perform the various operations.
- Identify the limitations of various machining process with regard to shape formation and surface texture.

REFERENCE BOOKS:

1. HMT, Production Technology, Tata McGraw Hill, 1998.
2. ASTME, Tool Engineers Hand Book, 2nd Ed.
3. Burghardt, Asilered, Anderson, Machine Tool Operations I & II, McGraw Hill.
4. W. A. J. Chapman, Workshop Technology: Part 2, CBS Publishers, 4th Ed.
5. R. V. Rao, Metal Cutting and Machine Tools, S K Kataria & Sons, Vol 2, 4th Ed.

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

ME19 601	THERMAL ENGINEERING	3-1-0-4

PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVES:

- To acquire knowledge on the working of steam turbines, IC engines and gas turbines
- To introduce the combustion process in IC engines
- To understand air pollution from IC engines and its remedies.
- To impart the concept of power plant technology.
- To develop understanding about power plant cycles and power generation devices.

SYLLABUS:

Module I: (8 hours)

Internal combustion engines: classification of I.C. Engines- four stroke and two stroke I.C. Engines, Comparison of four stroke and two stroke Engine, Wankel Engine, comparison of Otto, diesel and dual combustion cycles.

Stirling and Ericsson cycles (basics only-no numerical). Rotary engines, Stratified charge engine, super charging of SI and CI Engines – turbo charging.

Module II: (11 hours)

Performance Testing of I.C. Engines: Indicator diagram, mean effective pressure. Torque, Engine power- BHP, IHP. Engine efficiency mechanical efficiency, volumetric efficiency, thermal efficiency and relative efficiency, Specific fuel consumption. Testing of I C engines. Morse test, Heat balance test and Retardation test Fuels and fuel combustion - flash point and fire point, calorific value, Fuels for SI and CI engine, Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas. A/F ratio, equivalence ratio, flue gas analysis.

Module III: (10 hours)

Air pollution from I.C. Engine and its remedies: Pollutants from S.I. and C.I. Engines, Methods of emission control, alternative fuels for I.C. Engines; the blending of fuels, Bio fuels.

Combustion in I.C. Engines: Combustion phenomena in S.I. engines; Ignition limits, stages of combustion in S.I. Engines, Ignition lag, velocity of flame propagation, auto ignition, detonation; effects of engine variables on detonation; theories of detonation, octane rating of fuels; pre-ignition; S.I. engine combustion chambers.

Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers.

Module IV: (12 hours)

Steam cycles- Rankine cycle, Modified Rankine cycle, Relative efficiency, Improvement in steam cycles-Reheat, Regenerative and Binary vapour cycle, Co-generation, Combined cycle. Analysis of Gas turbine cycles - open and closed cycles - regeneration - reheating – inter cooling - efficiency and performance of gas turbine (Simple numerical only)

Module V: (11 hours)

Steam Boilers: Types of boilers –Cochran boiler, Babcock and Wilcox boiler, Benson boiler, La Mont boiler, Loeffler boiler, Velox boiler, Boiler Mountings and Accessories.

Steam nozzles: Types of nozzle- Velocity of steam, mass flow rate, critical pressure ratio and its significance, effect of friction, super saturated flow.

Steam turbines: Classification, compounding of turbines-pressure velocity variation, governing of turbines (Theory only-No numerical in this section)

COURSE OUTCOMES:

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

- Discuss various types of I.C. Engines and Cycles of operation.
- Analyze the effect of various operating variables on engine performance.
- Explain normal and abnormal combustion phenomena in SI and CI engines.
- Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts.
- Describe the working principle and basic components of the gas turbine power plant

TEXT BOOKS:

1. R.K Rajput, Thermal Engineering, Laxmi publications, 2010.
2. Rudramoorthy, Thermal Engineering, McGraw Hill Education India, 2003.
3. Mahesh M Rathore, Thermal Engineering, McGraw Hill Education India, 2010.

***REFERENCE BOOKS*:**

1. T.D. Eastop and A Mcconkey, Applied thermodynamics for engineering technology, Pearson education, 1996.
2. J.B.Heywood, I.C engine fundamentals. McGraw-Hill, 2011.
3. Gill, P.W., Smith, JR., J.H., and Ziurys, E.J Fundamentals of internal combustion engines Oxford and IBH, 1959.
4. V. Ganesan, Fundamentals of IC engines, Tata McGraw-Hill, 2002.

STEAM TABLES PERMITTED FOR REFERENCE IN THE FINAL EXAMINATION:

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

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 602	MACHINE DESIGN I	3-1-0-4

PRE-REQUISITE: Mechanics of Solids

COURSE OBJECTIVES:

- To provide understanding about design of various basic mechanical elements
- To introduce basic methods to prevent failure of components

SYLLABUS:

Module I: (12 hours)

Introduction to Design: Steps in design process, design factors, principles of standardization, selection of materials; tolerances & fits, strength of mechanical elements, stress concentration, methods to reduce stress concentration, theoretical stress concentration factor. Theories of Failure- Guest's Theory, Rankine's Theory, St. Venant's Theory, Haigh's Theory, and Von Mises and Hencky Theory, Shock and impact loads, fatigue loading, endurance limit stress, factors affecting endurance limit, factor of safety.

Module II: (12 hours)

Riveted joints: Stresses in riveted joints, design of riveted joints, failure and efficiency of riveted joints

Design of boiler and tank joints, cotter and knuckle joints

Module III: (10 hours)

Threaded fasteners: Terminology, thread standards, types of threads, stresses in screw threads. Bolted joints; preloading of bolts; eccentric loading; gasketed joints, analysis of power screws.

Module IV: (10 hours)

Welded joints: Types of welded joints, stresses in butt and fillet welds, torsion and bending in welded joints, welds subjected to fluctuating loads, eccentrically loaded welds

Springs: Stresses in helical springs, deflection of helical springs for axial loading, design of helical springs for static and fatigue loading, critical frequency of helical springs, stress analysis and design of leaf springs

Module V: (8 hours)

Power shafting: Stresses in shafts, design for strength and rigidity, design for static and fatigue loading, reversed bending, critical speed of shafts.

Couplings: classification, design of couplings, rigid and flexible couplings, design of keys and pins

COURSE OUTCOMES:

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

- Critically analyze a problem with a focus on optimistic design.
- Design components that are adaptable with various standards for robust design.
- Design mechanical systems that are reliable and efficient by proper selection of suitable materials and design considerations.
- Assume proper assumptions and conditions in complex engineering problems that will help to reduce the complexity and to produce better results.
- Investigate a failure, based on solid fundamental concepts.

TEXT BOOKS:

1. J. E. Shigley, Mechanical Engineering Design, McGraw Hill Book Company, 9th Ed.
2. M. F. Spotts, T. E. Shoup, Design of Machine Elements, Pearson Education. 8th Ed.

***REFERENCE BOOKS*:**

1. Juvinall R. C., Marshek K. M., Fundamentals of Machine Component Design, John Wiley, 6th Ed, 2018.
2. S. Md. Jalaludeen, Machine Design, Anuradha Publications, 3rd Ed, 2006.
3. TV Sundararaja Moorthy, Machine Design, Anuradha Publications, Chennai, 2018.
4. Doughtie V. I., Vallance A. V., Design of Machines, McGraw Hill Book Company, 4th Ed, 1964.
5. Siegel, Maleev, Hartman, Mechanical Design of Machines, International Book Company, 4th Ed, 1968.
6. James Baralla, Design for Manufacturability Handbook, McGraw Hill, 2nd Ed, 1998.

DATABOOKS PERMITTED FOR REFERENCE IN THE FINAL EXAMINATION:

1. PSG Design Data, DPV Printers, Coimbatore, 2020
2. Prof. Narayana Iyengar B. R., Dr. Lingaiah K., Machine Design Handbook, Vol I & II
3. K. Mahadevan, K. Balaveera Reddy, Design Databook, CBS Publishers & Distributors, 2nd Ed, 2019.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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 (*5x 20= 100*) *(Maximum Marks-100)*

There will be total of TEN questions - TWO questions from each module with choice to answer one question. Each main question carries 20 marks. This will enable to have the freedom of setting lengthy, design question or combination of short answer/problems/ essay/design in each main question.

ME19 603	DYNAMICS OF MACHINERY	3-1-0-4

PRE-REQUISITE: Mechanics of Machinery

COURSE OBJECTIVES:

- To impart knowledge on Force analysis of machinery, balancing of rotating and reciprocating masses, Gyroscopes, Energy fluctuation in Machines.
- To introduce the fundamentals in Vibration, Vibration analysis of Single degree and multi degree freedom systems.
- To impart knowledge required to understand the physical significance and design parameters related to vibration in mechanical systems.

SYLLABUS:

Module I: (10 hours)

Static Force analysis of plane motion mechanisms -- Conditions of equilibrium - Graphical method - Static force analysis with friction - Friction circle - Force Analysis of Spur, Helical, Bevel and Worm gear -Analytical methods like Matrix methods, method of virtual work and Superposition principle

Module II: (10 hours)

Dynamic force analysis of plane motion mechanisms- D'Alembert's principle-Determination of inertia forces -shaking forces-Dynamics of reciprocating engines Turning moment on the crank shaft-effect of inertia of the piston, crank and connecting road in turning moment- Equivalent system of the connecting rod

Module III: (11 hours)

Balancing - static and dynamic balancing of masses rotating in several planes - Balancing of reciprocating masses Analytical conditions for the balancing of reciprocating engines- Primary forces and secondary forces - primary moments and secondary moments-Partial balancing of locomotives-balancing of multi-cylinder in-line engines, V-engines-radial engines Concept of direct crank and reverse crank- balancing machines
Gyroscope – Gyroscopic action and reaction couples –Effect of gyroscopic couple on wheel reactions of two wheeled and four wheeled vehicles-- Gyroscopic Stabilization of ships and aeroplanes. Fly wheel analysis -Coefficient of fluctuation of speed- Calculation of the flywheel mass.

Module IV: (11 hours)

Introduction to vibrations - Undamped free vibrations of single degree freedom systems - Energy Method - Single degree freedom torsional Systems - Damped free vibrations - Viscous damping - Critical Damping - Logarithmic Decrement - Coulomb damping
Analysis of vibration due to support motion - Transmissibility and isolation - whirling of shafts (only undamped system) - Critical speed

Module V: (10 hours)

Free vibrations of undamped two degree of freedom systems - Equations of Motion for Forced Vibration - Dynamic vibration absorbers.
Torsionally equivalent shaft - Free vibration of two and three rotor systems - Determination of Mode shape - Fundamental natural frequency of loaded beams through Dunkerley's Empirical equation.

COURSE OUTCOMES:

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

- Develop the design and practical problem-solving skills in the area of mechanisms
- Discuss the basics of vibration and apply the concepts in design problems of mechanisms.
- Explain the balancing of reciprocating and rotary masses
- Analyze stabilization of sea vehicles, aircrafts and automobile vehicles.
- Explain the dynamic force analysis of slider crank mechanism and design of flywheel.

TEXT BOOKS:

1. J. E. Shigley, J. J. Uicker, Theory of Machines and Mechanisms, McGraw Hill, 1995.
2. Singiresu S. Rao, “Mechanical Vibrations”, Pearson Education, Fourth Edition, 2004

***REFERENCE BOOKS*:**

1. S. S. Rattan, Theory of Machines, 2nd Edition, Tata McGraw-Hill. 3rd Ed.
2. J P Den Hartog, Mechanical Vibrations, Dover Publications, 1985.
3. W. T. Thompson, Theory of Vibrations with Applications, Pearson Education, 2008.
4. Charles E. Wilson and J. Peter Sadler, Kinematics and Dynamics of Machinery, 3rd Edition, Pearson Education, 2008.
5. A. Ghosh, A. K. Malik, Theory of Mechanisms and Machines, Affiliated East West Press, 2008.
6. William W. Seto, “Theory and Problems of Mechanical Vibrations”, McGraw-Hill International Editions (Schaum’s Outline Series), Singapore, 1983.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 604	OPERATIONS RESEARCH	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To understand the role of operation research in decision making
- To understand the characteristics of different types of decision-making environments to formulate and solve a real-world problem as a mathematical programming model.

SYLLABUS:

Module I: (8 hours)

Brief history, Development of OR, Phases of OR, Scope of OR, Advantages and limitations of OR, Fundamental theorem of linear programming

Formulation and application of linear programming to production, marketing, finance and other areas Concepts of Solution space, convex region, basic feasible solution, optimal solution, Graphical solutions of two decision variable problems

Module II: (12 hours)

Solving LPP by Simplex method, Slack and surplus variables, Basic feasible solutions, Reduction of a feasible solution to a basic feasible solution, Artificial variables, Optimality conditions, Unbounded solutions, Big M method, Two phase method, Degeneracy, Duality.

Module III: (12 hours)

Transportation problem, Formulation, Balanced & unbalanced transportation problems, North west corner rule, least cost method, Vogel's method, stepping stone method, MODI method, Assignment problem, Formulation, optimal solution, Hungarian algorithm, Variants of assignment problems Traveling salesman problem.

Module IV: (10 hours)

Decision theory, Steps in decision theory approach, Decision making conditions, Decisions under conditions of risk, Decisions under uncertainty conditions, Decision tree analysis, Game theory, games with saddle points, Games without saddle points – 2 x 2 games, Graphical method for m x 2 & 2 x n games

Module V: (10 hours)

Introduction to queuing theory–terminologies– classification of queuing models. Single server problems, Multi server problems.

Inventory control – variables – deterministic inventory models – purchasing model without shortages, Manufacturing model without shortages, Purchasing model with shortages,

Manufacturing model with shortages.

COURSE OUTCOMES:

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

- Explain operations research techniques and apply them in solving practical problems in industry.
- Analyse the mathematical tools that are needed to solve optimisation problems.
- Solve Linear Programming Problems
- Solve Transportation and Assignment Problems
- Explain the usage of game theory and determine the solutions for queuing problems and inventory control models and its solutions

TEXT BOOKS:

1. Miller, D. M. and Schmidt, J. W., Industrial Engineering and Operations Research, John Wiley & Sons, Singapore, 1990.
2. Paneerselvam. R., Operations Research, Prentice Hall of India, New Delhi, 2008.
3. Pannerselvam. R., Design and Analysis of Algorithms, Prentice Hall of India, New Delhi, 2007.
4. Srinivasan, G. "Operations Research-Principles and Applications", Latest edition, PHI Pvt. Ltd., 2010

***REFERENCE BOOKS*:**

1. Banks, J., Carson, J. S., Nelson, B. L., and Nicol, D. M., Discrete-Event System Simulation, Third Edition, Pearson Education, Inc., 2001
2. Goel B. S, Mittal S. K., Operations Research, Pragati Prakashan, Meerut, 2014.
3. Ravindran, Phillips and Solberg, Operations Research Principles and Practice, Willey & Sons, 1987.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 605(A)	GAS DYNAMICS & JET PROPULSION	3-1-0-3

PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVES:

- To impart concept of compressible fluid flow and flow through duct and nozzle under various conditions.
- To provide knowledge on jet propulsion and rocket propulsion.

SYLLABUS:

Module I: (10 hours)

Introduction to compressible flow – continuum concept – control volume analysis - continuity, momentum, and energy equations for compressible flow – velocity of sound – equation for acoustic velocity – Mach number – flow regimes – Mach angle – Mach cone – Sonic boom – classification of flow based on Mach number – wave propagation in incompressible, subsonic, sonic and supersonic flow – Karman's rule of supersonic flow – compressibility factor and effect of Mach number on compressibility.

Module II: (10 hours)

One dimensional isentropic flow with variable area – general features and governing equations – stagnation property – reference velocities – dimensionless Mach number M* - Crocco number – area velocity relation - Mach number variation – area ratio – Nozzle and Diffusers – critical state – Chocking –mass flow rate of chocked flow – Impulse function and Thrust – operation of convergent and convergent divergent Nozzle under varying pressure ratio – over expanded and under expanded mode.

Module III: (10 hours)

Flow with Normal shock waves – development of normal shock - Prandtl-Mayer relation – Rankine-hugoniot equations – properties of flow across normal shock – impossibility of a shock in subsonic flow.

Flow with oblique shock waves – nature of flow through oblique shock waves – Prandtl's equations -– Rankine-hugoniot equations – properties of flow across oblique shock – oblique shock relations from the normal shock equations – θβM curves - shock polar diagram.

Module IV: (12 hours)

Adiabatic flow through constant area duct with friction – Fanno curves – illustration of Fanno line on h-s diagram – Fanno flow equations - chocking due to friction, effect of friction on flow parameters – isothermal flow with friction.

Flow through constant area duct with heat transfer – Rayleigh curves – illustration of Rayleigh line on h-s diagram – Rayleigh flow equations - condition for maximum heat transfer – thermal chocking – effect of heat transfer on flow parameters.

Module V: (10 hours)

Aircraft propulsion – types of aircraft engines – turbo-prop engines – turbojet engines – turbofan engines – aircraft propulsion theory – propeller thrust and jet thrust – propulsive, thermal and overall efficiencies – specific fuel consumption, specific thrust and impulse – ramjet engine – pulsejet engine.

Rocket propulsion – types of rocket engines – liquid propellant rocket engines – solid propellant rocket motors – rocket propulsion theory – rocket applications.

COURSE OUTCOMES:

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

- Explain basic concepts of gas dynamics and describe the basic fundamental equations of one dimensional flow of compressible fluid and isentropic flow of an ideal gas.
- Analyze the steady one-dimensional isentropic flow, frictional flow and isothermal flow and express the concepts of steady one dimensional flow with heat transfer.
- Discuss the effect of heat transfer on flow parameters.
- Describe the jet propulsion engines
- Describe the basic concepts of rocket propulsion

TEXT BOOKS:

1. S.M. Yahya, Fundamentals of compressible fluid flow with aircraft and rocket propulsion, New Age International publishers, 3rd Ed, 2004.
2. V Ganeshan Internal combustion engines, McGraw Hill, 4th Ed, 2017.

***REFERENCE BOOKS*:**

1. P. Balachandran, fundamentals of compressible fluid dynamics, PHI learning pvt. Ltd, 2006.
2. John d. Anderson,jr., modern compressible flow with historical perspective, McGraw-Hill publishing company, 2017.
3. A H Shapiro, dynamics and thermodynamics of compressible flow, Ronald press, 1977.
4. M.J. Zucro, D.H. Holfman, gas dynamics, McGraw-Hill publishing company, 1976.
5. V. Babu, fundamentals of gas dynamics, ane books pvt. Ltd., 2014.
6. E. Radhakrishnan, gas dynamics, prentice hall of India pvt. Ltd., 2017.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 605(B)	DESIGN OF JIGS AND FIXTURES	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To acquaint basics of identification and selection of location and clamping points on work-piece
- To provide knowledge on design of different cutting tools.
- To develop comprehensive idea on design of jigs and fixtures

SYLLABUS:

Module I: (10 hours)

Location- method of location – Principles of location– 3-2-1principle- types of location – plane surface- six point- profile- cylindrical- conical- vee-redundant- nest locator- radial – extreme locations.

Module II: (10 hours)

Clamping – principles of clamping types of clamps – screw – strap- swing- wedge- multiple- magnetic – latch- self-locking –toggle clamps- hydraulic and power clamping.

Module III: (11 hours)

Jigs – Classification of jigs- Principles of design of jigs- elements of jig- types of drill jigs- template- sandwich- leaf – box- indexing- drilling and reaming jigs- guide bushings- Simple design for drill jigs.

Module IV: (10 hours)

Fixtures- Elements of fixture- standard work holding devices- mandrels- collets- chucks- magnetic and vacuum chucks- face plates-Indexing Fixture-Application of indexing, essential features of an indexing fixture, Indexing Devices

Module V: (11 hours)

Milling fixture- indexing fixture- grinding fixture- welding and assembly fixtures- modular fixtures- design & sketching of fixtures for turning & milling of simple components

COURSE OUTCOMES:

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

- Describe the basic principles of location.
- Identify and describe the basic principles of clamping.
- Design assembly of jigs on simple components.
- Describe about various work holding devices.
- Design & sketch fixtures for turning & milling of simple components.

TEXT BOOKS:

1. P H Joshi, Jigs & Fixtures, Tata McGraw Hill, 3rd Ed, 1998.

***REFERENCE BOOKS*:**

1. Cyril Donaldson, Tool Design, Tata McGraw Hill, 1976
2. Sharma P C, A Text book of Production Engineering, S Chand & Co., 1999
3. Jain R K, Production Technology, Khanna Publishers, 2003.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 605(C)	FINITE ELEMENT METHOD	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To learn the mathematical background of finite element methods.
- To acquaint the basics of finite element formulation.
- To practice finite element methodologies through simple structural and heat transfer problems.

SYLLABUS:

Module I: (8 hours)

Introduction to Finite Element Method (FEM) - Brief history- Application of FEA- Advantages and disadvantages. Review of elasticity- Strain displacement relations- Compatibility-Stress strain relations- Boundary conditions- Plane stress, plane strain and axisymmetry.

Direct approach-1D bar element- element stiffness- Assembly of elements- properties of [K] matrix- Treatment of boundary conditions - Stress computation.

Module II: (10 hours)

Analogous problems of torsion, heat conduction and laminar pipe flow. Beam elements- FE formulation-element stiffness matrix- boundary conditions.

Plane truss- Element formulation- Co-ordinate transformation- Local and global co-ordinates- Stress calculations. Simple problems-band width of the stiffness matrix, node numbering to exploit matrix sparsity – conservation of computer memory.

Module III: (12 hours)

Interpolation functions-Shape functions- Lagrange interpolation- 1D linear and quadratic element. FE formulation from virtual work principle – B-matrix element matrices for bar and CST elements – load considerations – simple problems.

Variational methods: Functionals- Strong and weak form- Essential and natural boundary conditions

Module IV: (11 hours)

Principle of stationary potential energy- Rayleigh Ritz method – simple examples

FE formulation from a functional – 2-D steady state heat conduction – element matrices for a triangular element – boundary conditions – simple problems - FE formulation for 2-D stress analysis from potential energy – element matrices – plane bilinear element.

Module V: (11 hours)

Weighted residual method: Galerkin FE formulation. Axially loaded bar, Heat flow in a bar. Iso parametric elements, Natural coordinates, Area co-ordinates - Quadrilateral elements- Jacobian matrix-Gauss quadrature. Higher order elements- Quadratic and cubic elements- Pascal's triangle - Serendipity elements.

Structure of FEA software package. Introduction to Modal analysis, nonlinear analysis and coupled analysis.

COURSE OUTCOMES:

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

- Analyse the mathematical background of FEM.
- Solve real life problems using finite element analysis.
- Discuss the application and use of the FEM for heat transfer problems.
- Explain the use of the basic finite elements for structural applications using beam, plane elements etc.
- Demonstrate the ability to create models for trusses, frames, machine parts and components using ANSYS general-purpose software.

TEXT BOOKS:

1. Chandrupatla T R., Finite Element Analysis for Engineering and Technology, University Press, 2004.
2. Logan D L., A first course in the Finite Element Method, Thomson-Engineering, 2012.
3. Hutton D V., Fundamentals of Finite Element Analysis, Tata McGraw-Hill, 2005.
4. Seshu P., Text Book of Finite Element Analysis, PHI Learning Pvt. Ltd., 2003.

***REFERENCE BOOKS*:**

1. Reddy J N., An introduction to the Finite Element Method, McGraw- Hill, 2006.
2. Cook R D, Malkus D S, Plesha M E, Witt R J, Concepts and Analysis of Finite Element Applications, John Wiley & Sons, 1981.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 605(D)	NON-CONVENTIONAL MANUFACTURING TECHNIQUES	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- Understand conventional and non-conventional manufacturing term.
- Learn different types of unconventional machining process and advance machines.
- Learn different types of unconventional joining process and advance joining machines.
- Learn different types of unconventional forming process.

SYLLABUS:

Module I (10 hours)

Introduction: Limitation of conventional manufacturing processes, need of unconventional manufacturing process and its classification. High strength alloys, Complex surfaces, Higher accuracies and surface finish.

Module II (11 hours)

Unconventional machining processes: Principle, working and applications- Mechanical energy based NCM: Abrasive jet machining (AJM), water jet machining (WJM), Abrasive water jet machining (AWJM) Electro thermal energy based NCM: electro-discharge machining (EDM), Wire- electro discharge machining (WEDM)

Chemical energy based: electrochemical machining (ECM), chemical machining

Module III (10 hours)

Principle and working and applications of unconventional machining processes: High energy density methods: Laser beam machining (LBM), Electron beam machining (EBM), Plasma arc machining (PAM) Hybrid machining: Electro chemical discharge machining (ECDM), Ultrasonic assisted EDM, Electro chemical discharge grinding, Powder suspended EDM Electro discharge coating.

Module IV (10 hours)

Unconventional welding process: Principle and working and applications of unconventional welding processes such as laser beam welding, electron beam welding, ultrasonic welding, plasma arc welding, explosive welding, cladding etc. under water welding, metallizing.

Module V (11 hours)

Unconventional forming processes, principle, working and applications of high energy forming processes such as explosive forming, electromagnetic forming, electro-discharge forming, water hammer forming, explosive compaction etc.

COURSE OUTCOMES:

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

- Compare and classify the different unconventional machining processes based on their energy domain and interactions with work pieces.
- Explain the principle, working and applications of unconventional welding process.
- Implement water energy, electro-magnetic, electro discharge and explosive energy for forming process.
- Model mathematically and analyze various unconventional machining process.
- Recognize the need of industries current necessity and environment related issue through case study discussions.

TEXT BOOKS:

1. P.N. Rao, Manufacturing Technology, McGraw Hill, 4th Ed, 2017.
2. R.K. Jain, Production Technology, Khanna Publishers, 2003.
3. V.K. Jain, Advanced Machining Process, Allied Publishers Pvt. Ltd, 2007

***REFERENCE BOOKS*:**

1. Pandey and H.S.Shen, Modern Machining process, McGraw Hill.
2. Ghosh, A. K. Mallik, Manufacturing science, East-West Press Pvt. Ltd., 2nd Ed, 2010.
3. K Mishra, Nonconventional Machining, Narosa Publishing House, 1997.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 605(E)	COMPOSITE MATERIALS	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To introduce various types of composite materials
- To understand various post processing operations and micro mechanics of composites

SYLLABUS:

Module I: (12 hours)

Introduction to composites: Characteristics and classifications of composites – fibers, flake and particulate composites, Interfaces: wettability and bonding interface in composites – types of bonding at interface.

Module II: (12 hours)

Manufacturing methods: Production of various fibers – matrix materials and surface treatments, fabrication of composites, fabrication of thermosetting resin matrix composites – fabrication of thermoplastic resin matrix composites – short fiber composites – fabrication of metal matrix and ceramic matrix composites

Module III: (10 hours)

Testing aspects of composites: Experimental characterization of composites – uniaxial tension, compression and shear tests – determination of interlaminar fracture toughness – damage identification through non- destructive evaluation techniques – ultrasonic, acoustic emission and X-radiography

Module IV: (10 hours)

Mechanical behavior of UD composites: Longitudinal strength and stiffness – transverse strength and stiffness – failure modes – analysis of laminated composites – stress – strain variation in a laminate

Module V: (8 hours)

Post processing operations: machining, cutting, polishing, welding, riveting and painting advanced post processing methods: ultrasonic welding, plasma coating, Water jet cutting and laser machining

COURSE OUTCOMES:

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

- Discuss the various methods to produce high strength low density materials for various engineering purpose.
- List out the various components of composites for efficient material selection.
- Apply fundamental principles of strength and property calculations of composites for robust design.
- Select proper machining methods for various composites.
- Test and analyse the strength and various properties of composites.

TEXT BOOKS:

1. B. D. Agarwal, L. J. Broutman, Analysis and Performance of fiber composites, John Wiley, 3rd Ed, 2006.

***REFERENCE BOOKS*:**

1. R. F. Gibson, Principle of Composite Material Mechanics, McGraw Hill, 1994.
2. M. M. Schwartz, Composite Materials Handbook, McGraw Hill Inc., 2nd Ed, 1992.
3. R. M. Jones, Mechanics of Composite Materials, McGraw Hill Inc., 2nd Ed, 1999.
4. S. W. Tsai, Introduction to composite Materials, Technomic Publishing Company, 1980.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 605(F)	TOOL ENGINEERING AND DESIGN	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To enable selection of proper tool for given manufacturing operation
- To interpret designation system of cutting tool and tool holder.
- To select and design jig and fixture for given simple component.
- To know various press tools and press tools operations.

SYLLABUS:

Module I: (10 hours)

Tool engineering and role of tool engineer in design and manufacturing of products, Cutting tool materials, properties, classification, selection, tool wear, and tool life. Single point tools: nomenclature, types and styles, design and manufacture of tools in HSS and carbides, tools for turning, boring, shaping, planning and slotting operations, form tools. Multipoint cutters, nomenclature, classification and selection, construction methods, design and manufacture of drills and milling cutters.

Module II: (11 hours)

Design of drill jigs and fixtures for conventional machines, jig bushes, concept of 3-2-1 principle, dowel and diamond pin locations, poke-yoke, different type of jigs, true position theory and material conditions, modular concepts, chip disposal.

Module III: (11 hours)

Clamping methods-pneumatic and hydraulic systems, variable clamping force vices, hydraulic work supports, swing clamps, chip disposal, tool setting gauges, modular fixturing. Turning & Milling fixtures for surface, cylindrical and internal grinding machines, vacuum chucks, chucks for grinding bearing races. Fixtures for inspection, assembly, welding.

Module IV: (10 hours)

Mechanical and hydraulic power presses, accessories for power presses-coiler and de-coiler, straightening, feed units, fundamentals of blanking and piercing, tool clearances, standard die sets, design of simple and compound tools, design of progressive tools with manual and auto feed, die materials, deep drawing and forming tools.

Module V: (10 hours)

Plastic materials, shrinkage, two and three plate mold design, standard mold plates, parting line, core and cavity generation , runner and gate design, mold cooling, ejection methods, tool materials, runner less molds.

COURSE OUTCOMES:

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

- Select proper tool for given manufacturing operation and to interpret designation system of cutting tool and tool holder.
- Design jigs and fixtures for simple components.
- Discuss about various Clamping methods.
- Discuss different press tools and its operations.
- Discuss the core aspects of developing the dies used for plastic and rubber molding.

TEXT BOOKS:

1. Joshi P H, "Jigs and Fixtures", Tata McGraw Hill, 1988.
2. Kempster M H A, "An Introduction to Jig and Tool Design", Viva Books Pvt. Ltd, 1998.
3. Ostergaurd D E, "Basic Die Making", McGraw Hill, 1963.

***REFERENCE BOOKS*:**

1. Pye R C W, "Injection Mold Design", East West Press, 2000.
2. Grant H E, Quot, Non Standard Clamping Devices, Tata McGraw Hill, 2001
3. Paquin, "Press Tool Design Fundamentals", Indian Institute of Science, 1986.
4. SME, "Tool and Manufacturing Engineers Hand book", Vol. II Forming, Fourth Edition, 1988.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 606(A)	PRODUCT DESIGN AND DEVELOPMENT	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services.
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems.
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification.
- To understand system modelling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics generation devices.

SYLLABUS:

Module I: (10 hours)

Introduction: Classification/ Specifications of Products. - Product life cycle. Product mix. - Introduction to product design. - Modern product development process- Innovative thinking. - Morphology of design.

Module II: (10 hours)

Conceptual Design: Generation, selection & embodiment of concept. Product architecture. Industrial design: process, need. Robust Design: Taguchi Designs & DOE. Design Optimization.

Module III: (10 hours)

Design for Manufacturing & Assembly: Methods of designing for Manufacturing & Assy. Designs for Maintainability. Designs for Environment. 3Product costing. Legal factors and social issues. Engineering ethics and issues of society related to design of products.

Module IV: (11 hours)

Value Engineering / Value Analysis: Definition. Methodology. Case studies. Economic analysis: Qualitative & Quantitative.

Concurrent Engineering, Rapid prototyping, Tools for product design – Drafting/Modelling software.

Module V: (11 hours)

Ergonomics / Aesthetics: Gross human autonomy. - Anthropometry. - Man-Machine interaction. - Concepts of size and texture, colour. Comfort criteria. - Psychological & Physiological considerations. - Creativity Techniques: Creative thinking, conceptualization, brain storming, primary design, drawing, simulation, detail design.

COURSE OUTCOMES:

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

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXT BOOKS:

1. Development", Tata McGraw Hill, Fifth Edition, 2011.
2. Kevin Otto, Kristin Wood Product Design: "Techniques in Reverse Engineering and new Product Development." 1 / e 2004, Pearson Education New Delhi

***REFERENCE BOOKS*:**

1. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
2. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", Second Edition, Prentice Hall, 2003.
3. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2003.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 606(B)	QUALITY ENGINEERING AND MANAGEMENT	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To analyze key definitions of quality, focusing on a customer – centric approach.
- To provide knowledge on the managerial tools and techniques on quality
- To analyze the relationship of statistics to a process and to use the statistical tools
- To analyze and generate acceptance sampling plans
- To provide knowledge on the reliability and life testing of components and systems.

SYLLABUS:

Module I: (11 hours)

Concepts of quality- Quality control- Quality assurance- Quality management - Quality costs, Total Quality Management: Axioms- Management commitment-Deming's approach- Quality council- Customer satisfaction and retention- Employee involvement and empowerment-Suggestion system- Quality circle-Continuous process improvement Juran's triology-PDSA cycle-Kaizen-Six sigma -Crosby's quality treatment.

Module II: (11 hours)

Management tools and techniques- Benchmarking-ISO quality management systems-Quality function deployment- Quality by design –Failure mode and effect analysis-Affinity diagram-Block diagram-Pareto chart-Fish bone diagram- Flow chart- Run chart-Scatter diagram-Tree diagram –Matrix diagram

Module III: (10 hours)

Statistical tools: Basic concepts- Attributes and variables- Random and assignable causes of variations-Patterns of variation – Measures of central tendency and dispersion-Probability distributions: Binomial, Poisson and Normal

Module IV: (10 hours)

Control charts: Control charts for variables, X, R and sigma charts- Details of construction and uses Control charts for attributes: p, np, c and u charts-Details of construction and uses (numerical problems included)

Module V: (10 hours)

Statistical tools 2-Acceptance sampling, Reliability and life testing: Sampling Vs inspection – OC curve-Single and double sampling plans-ATI-AOQL-Life testing- System reliability (Numerical problems included)

COURSE OUTCOMES:

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

- Apply the tools and techniques of quality to resolve industrial engineering issues.
- Know about various management tools and techniques.
- Know about the statistical tools.
- Prepare and analyze various charts/ methods for quality control and improvement.
- Use plans for sampling and concepts of quality system management.

TEXT BOOKS:

1. M Mahajan, Statistical Quality Control, Dhanpath Rai & Co., 2016.

***REFERENCE BOOKS*:**

1. Logothetis N, Managing for Total Quality, Prentice Hall International, 1992.
2. Eugene L. Grant, Richard S. Leavenworth, Statistical Quality Control, McGraw Hill, 7^{th} Ed, 1996.
3. Juran J.M, Gryna F M, Quality Planning and Analysis, Tata McGraw Hill Publishing Company, 2017.
4. Montgomery, Douglas C, Introduction to Statistical Quality Control, Fourth edition, John Wiley and Sons, Inc., New Delhi, 2001.
5. Gerald M Smith, Statistical Process Control and Quality Improvement, Pearson, 5^{th} Ed, 2003.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 606(C)	ENTREPRENEURSHIP & BUSINESS ANALYTICS	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To give an idea on entrepreneurial perspectives
- To understand the Role of Business Analyst in business.
- To understand the application of business analysis.

SYLLABUS:

Module I: (10 hours)

Entrepreneurial perspectives- understanding of entrepreneurship process- entrepreneurial decision process- entrepreneurship and economic development- characteristics of entrepreneur- entrepreneurial competencies- managerial functions for enterprise.

Module II: (10 hours)

Process of business opportunity identification and evaluation- industrial policy- environment-market survey and market assessment- project report preparation-study of feasibility and viability of a project assessment of risk in the industry

Module III: (10 hours)

Process and strategies for starting venture- stages of small business growth- entrepreneurship in international environment- entrepreneurship- achievement motivation- time management creativity and innovation structure of the enterprise- planning, implementation and growth.

Module IV: (12 hours)

Introduction of business analytics: basic concepts, Functions and limitations of statistics, measures of central tendency, basics of correlation & regression analysis and its applications, Baye's theorem probability and its applications, concept of business analytics hypothesis testing: null and alternative hypotheses; type I and type II errors; small sample test, (t, f, and chi square test), applications of hypothesis testing for a data and deriving conclusions.

Module V: (10 hours)

Types and application of business analytics, use of spread sheet to anlayze data-descriptive analytics and predictive analytics, career in business analytics. Basics and applications of retail analytics, marketing analytics, financial analytics, healthcare analytics, supply chain analytics.

COURSE OUTCOMES:

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

- Analyse the entrepreneurial perspectives.
- Analyse the business environment in order to identify business opportunities.
- Identify the elements of success of entrepreneurial ventures.
- Explain the basics of business analytics and statistical concepts.

- Describe the application of business analytics in different domain.

TEXT BOOKS:

1. Hisrich R.D., Peters Irwin M.P., Entrepreneurship, McGraw Hill, 10^{th} Ed, 2016.
2. Timmons J.A., New venture Creation- Entrepreneurship for 21st century, McGraw Hill International, 1999.
3. Pandey G.W., Complete Guide to successful Entrepreneurship, Vikas Publishing, 1994.
4. Glyn Davis, Branko Pecar, Business Statistics using Excel, Oxford, 2010.
5. Bhimasankaram Pochiraju, Sridhar Seshadri, Essentials of Business Analytics: An Introduction to the methodology and its application, Springer, 2019.
6. Mahajan M., Statistical quality Control, Dhanpat Rai & Co. (P) Limited, 2016

***REFERENCE BOOKS*:**

1. Rao T.V., Deshpande M.V., Prayag Mehta, Manohar S. Nadakarni, Developing Entrepreneurship a Hand Book, Learning systems.
2. Patel J.B., Noid S.S., A manual on Business Oppurnity Identification, selections, EDII.
3. Rao C.R., Finance for small scale Industries, Brahmi Publishers, 1990.
4. Chandrasekaran, Umaparvathi, Statistics for Managers, 1^{st} Ed, PHI Learning, 2015.
5. An Introduction to Business Analytics, Ger Koole, Lulu.com, 2019.
6. Douglas C. Montgomery, Introduction to Statistical Quality Control, 8th Edition, Wiley, 2019.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 606(D)	INDUSTRIAL INTERNET OF THINGS	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To familiarise with the concepts of internet of things.
- To Understand State of the Art – IoT Architecture.
- To Understand Real World IoT applications and Business Models.

SYLLABUS:

Module I: Introduction (9 hours)

The Internet of Things: An overview; Definition, scope and characteristics of IOT; Vision of IoT; Technology behind IoT- major components and development tools; IoT enabling technologies; Sources of IoT; Structure of IoT; IoT levels.

Module II: Architecture, design and connectivity principles (10 hours)

IoT protocols; Conceptual framework; Architectural view; IoT/M2M systems- layers and design standards; SDN and NFV for IoT; Communication technologies; Web communication protocols; Internet and application layer protocols.

Module III: Development of IoT platforms (11 hours)

IoT design methodology- Steps involved in IoT systems design; Sensor technology- sensor types and applications; Participatory sensing- Industrial IoT (IIoT), Automotive IoT; RFID IoT systems- principles and applications; Wireless Sensor Network (WSN) technology- concepts and applications; Case studies- Weather monitoring, Connected car.

Module IV: IoT prototyping and security (11 hours)

IoT device- definition and building blocks; Embedded platforms for prototyping- Arduino, Raspberry Pi, Intel Galileo, mBed, BeagleBone- features and IoT aaplications; Connecting things to embedded devices, Programming Arduino and Raspberry Pi using an IDE (basics only), Cloud platforms for IoT; Vulnerabilities for IoT and security requirements- Layered Attacker model; Security protocols.

Module V: Business models and Case studies (11 hours)

IoT business models- definition and types; business model innovation; Domain specific IoTs; Case studies: Smart lighting, Smart parking, Forest fire detection, Renewable energy systems, Inventory management, Remote vehicle diagnostics, Smart Irrigation, Indoor air quality monitoring, Health and fitness monitoring, Smart vending machines, Smart grids, Surveillance.

COURSE OUTCOMES:

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

- Explain in a concise manner how the general Internet as well as Internet of Things work.
- Use real IoT protocols for communication.
- Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
- Develop prototype models for various applications using IoT technology.
- Analyse the potential business opportunities that IoT can uncover.

TEXT BOOKS:

1. Internet of Things: A Hands-On Approach by Arshdeep Bahga, Vijay Madisetti. Universities press, Orient Blackswan Private Limited, 2015.
2. Internet of Things: Architecture and Design principles by Raj Kamal, Publisher: Mc Graw Hill Education, McGraw Hill Education, 2017.

***REFERENCE BOOKS*:**

1. Pethuru Raj and Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Auerbach Publications, 2017.
2. Samuel Greengard, The Internet of Things, (The MIT Press Essential Knowledge series), The MIT Press, 2015.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 606(E)	QUANTITATIVE TECHNIQUE FOR ENGINEERS	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- Understand the importance of the use of OR application in decision making.
- To formulate LPP and Obtain Graphical Solutions & Acquire General idea of the Simplex method.
- To understand and solve transportation & assignment models.
- To know optimal sequence model and understand concepts of queuing theory.
- To identify right time for replacement of equipment and understand project management techniques and statistical tools for data analytics.

SYLLABUS:

Module I: (9 hours)

Operations Research & Decision Making Environments Operations Research: Uses, Scope and Applications of Operation Research in managerial decision-making .Decision-making environments: Decision-making under certainty, uncertainty and risk situations; Decision tree approach and its applications.

Module II: (10 hours)

Linear Programming Problem & Transportation Problem Linear programming: Mathematical formulations of LP Models for product-mix problems; graphical and simplex method of solving LP problems; duality. Transportation problem: Various methods of finding Initial basic feasible solution-North West Corner Method, Least Cost Method & VAM Method and optimal solution-Stepping Stone & MODI Method, Maximization Transportation Problem

Module III: (11 hours)

Assignment model & Game Theory Assignment model: Hungarian Algorithm and its applications, Maximization Assignment Problem. Game Theory: Concept of game; Two-person zero-sum game; Pure and Mixed Strategy Games; Saddle Point; Odds Method; Dominance Method and Graphical Method for solving Mixed Strategy Game.

Module IV: (10 hours)

Replacement Problem & Project Management Replacement Problem: Replacement of assets that deteriorate with time, replacement of assets which fail suddenly. Project Management: Rules for drawing the network diagram, Applications of CPM and PERT techniques in Project planning and control; crashing of operations.

Module V: (12 hours)

Sequencing & Queuing Theory Sequencing Problem: Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, Two jobs and m - Machines Problems. Queuing Theory: Characteristics of M/M/I Queue model; Application of Poisson and Exponential distribution in estimating arrival rate and service rate; Applications of Queue model for better service to the customers (simple problems only), Basics of statistical tools like median and mode, Range, dispersion, standard deviation, hypothesis testing, coefficient of variation, and regression analysis for data analysis, Basics of management simulation.

COURSE OUTCOMES:

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

- Analyse the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.
- Formulate linear programming problem and to find optimal solution by graphical simplex method
- Build and solve Transportation Models and Assignment Models also to solve game theory problems by understanding pure and mix strategies.
- Assign optimal sequence of difference jobs on different machines and develop understanding of queuing theory concepts and do statistical data analysis.
- Implement replacement of equipment's at right time and able to implement project management concepts like CPM, PERT to reduce cost and time.

TEXT BOOKS:

1. N. D. Vohra- Quantitative techniques in Management, 5th Ed, Tata McGraw-Hill, 2017.
2. Er. Prem Kumar Gupta, Dr. D S Hira, Operations Research, S. Chand & Co, 1976
3. P. C. Tulsian, Vishal Pandey, Quantitative techniques in Management, 5th Ed, Pearson, 2002.
4. U K Srivasthava, Quantitative techniques in Management, 3rd edition, New Age International Private Limited, 2011.
5. R. Panneerselvam, Operations Research, 2nd Edition, PHI, 2006.
6. Ravindran, Phillips, Solberg, Operations Research Principles and Practice, 2nd Ed, Wiley, 2007
7. Sharma J. K., Operations Research, 6th Edition, Laxmi Publications, 2017.
8. M. Mahajan, Statistical Quality Control, 7th Ed, Dhanpat Rai Publishing, 2018

***REFERENCE BOOKS*:**

1. Taha Hamdy, Operations Research-An Introduction, 10th Ed, Pearson Education, 2019.
2. S. Kalawathy, Operation Research, 4th Edition, Vikas Publishing House, 2012
3. Natarajan, Balasubramani, Tamilarasi, Operation Research, Pearson Education India; 2nd edition, 2014.
4. C. R. Kothari - Quantitative Techniques, 3rd edition, Vikas Publishing House, 2013.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 606(F)	DISASTER MANAGEMENT	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide basic conceptual understanding of disasters and its relationships with development.
- To understand approaches of Disaster Risk Reduction and the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To understand Medical and Psycho-Social Response to Disasters.
- To enhance awareness of Disaster Risk Management institutional processes in India
- To build skills to respond to disasters.

SYLLABUS:

Module I: (12 hours)

Introduction- Hazard, Vulnerability, Risk, Disaster, classification of disasters, Risk and vulnerability analysis. Risk reduction-strategic development for vulnerability reduction, Disaster prevention and mitigation.

Natural disasters: water and climate based disasters-Earthquakes, Tsunami, Floods, Drought, Landslides, Cyclones and Volcanic eruptions, flood-hail storms, cloudburst, cyclones, heat and snow avalanches, cold waves, droughts, sea erosion, thunder and lightning. Geological disaster: landslides, earthquakes, Tsunami, mine fires, dam failures and general fires. Biological disaster: pest attacks, cattle epidemic and food poisoning, nuclear accidents, and industrial disaster: chemical and industrial disasters. Do's and Don'ts in various disasters. Accidental disaster: urban and forest fires, oil spill, mine flooding incidents, collapse of huge building structures and bridges. Accidents: Air, Sea, Rail & Road.

Note: (Basic concepts only and explanation can be done with discussing case studies)

Module II: (10 hours)

Disaster preparedness and response concept and nature disaster preparedness plan prediction, role of information, education, communication, and training. Disaster management: Role of Government, international and NGO bodies, Role of it in disaster preparedness role of engineers on disaster management. Disaster response: Rescue, Evacuation and Logistic Management, Psychological Response and Management (Trauma, Stress, Rumor and Panic) relief and recovery medical health response to different disasters. Rehabilitation: Reconstruction and recovery, Reconstruction and rehabilitation as a means of development, dealing with victim's psychology, long term counter disaster planning role of educational institute. The vulnerability atlas of India, Disaster prevention and mitigation, Agencies involved in disaster management.

Note: (Basic concepts only and explanation can be done with discussing case studies)

Module III: (10 hours)

Disaster profile of India – Mega disasters of India and lessons learnt disaster management act 2005 – Institutional and financial mechanism, National guidelines and plans on disaster management; Applications of science and technology for disaster management-geo-informatics in disaster management (RS, GIS, GPS and RS) Disaster Communication System (Early warning and its dissemination), Disaster safe designs and constructions, Structural and non-structural mitigation of disasters science & technology institutions for disaster management in India

Note: (Basic concepts only and explanation can be done with discussing case studies)

Module IV: (10 hours)

First Aid, Basic life support and causality handling, Basics- Triage- CPR, Chocking, breathing difficulties, bleeding, burns, electric shock, animal bites, fractures, bandaging, splints and slings, Hazardous chemicals-HazcHEMCODE, TREMCARD, Response in tanker lorry accidents

Basics of Firefighting- Operation of fire extinguishers and fire protection systems in buildings. Transportation of causality-methods of rescue, two hand seat, three hand seat, four hand seat, human crutch, pick a back, fire man lift, improvised stretchers

Note: (Help of Medical professionals and staff from Fire and safety department/ safety professionals can be sought for giving proper practical training to the students in the specific topics mentioned in module 4. Students can also develop their own innovative devices/ methods to help the fire & safety dept. in rescue operations. After successful training in rescue operations the students can form a student volunteer group in each college to associate with the with the activities of Fire & Safety/NDRF officials to help the society during an emergency)

Module V: (10 hours)

Flood Rescue, making of improvised floating aids, use of life buoy and life jacket, rope rescue, common rescue knots, chair knot, bow line etc.

Note: (Help of staff from Fire and safety department/safety professionals can be sought for giving practical training to the students in the specific topics mentioned in module 4. Students may come up with their ideas to develop innovative tools/techniques/methods/software's for helping various Govt. departments/Fire & safety/NDRF teams and society during the occurrence of any disasters)

COURSE OUTCOMES:

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

- Explain the basics concepts and types of disasters and accidents
- Explain the basics of disaster preparedness and response
- Explain the basics of disaster management Act and its features
- Build skills and practice the basics of first aid and the usage of lifesaving equipment's
- Develop skills and practice methods to save a life and respond during a flood disaster.

TEXT BOOKS:

1. S.C. Sharma, Disaster Management, 1st edition, Khanna Publishing House, 2018.
2. Ghosh G.K., Disaster Management, 1st edition, APH Publishing Corporation, 2006.
3. Singh B.K., Handbook of Disaster Management, 1st edition, Rajat Publication, 2008.
4. A.K. Singh, Disaster Management in India, 1st edition, New Royal Book Company, 2007.
5. D. Mondal, D. Basu, Disaster Management Concepts and Approach, CBS Publishers and Distributers, 2020.
6. R. Subramanian, Disaster Management, Vikas Publishing House, 2018.
7. M. M. Sulphy, Disaster Management, PHI Learning, 2017.
8. Satish Modh, Introduction to Disaster Management, Macmillan, 2009.

***REFERENCE BOOKS*:**

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
3. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
4. World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
5. Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
6. Encyclopedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
7. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
8. Management of Natural Disasters in developing countries, H.N. Srivastava, G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
10. Disaster Management Act 2005, Publisher by Govt. of India
11. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management (eg. Disaster Management for NDRF Commanders, Flood Risk Mitigation and Management, Village Disaster Management Plan etc)
12. NIDM Publications
13. High Power Committee Report, 2001, J.C. Pant
14. Disaster Mitigation in Asia & Pacific, Asian Development Bank
15. National Disaster Management Policy, 2009, GoI
16. Disaster Preparedness Kit, American Red Cross
17. Introduction to Incident Command System, First Edition, Centre for Disaster Management, Lal Bhadur Sasthri National Academy of Administartion.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 607 (P)	THERMAL ENGINEERING LAB I	0-0-3-1

PRE-REQUISITE: Thermal Engineering & Heat and Mass transfer

COURSE OBJECTIVES:

- To strengthen the knowledge on heat engine and heat transfer principles through lab experiments
- To train students in the calibration and use different measure instruments.
- To equip the students to carry out independent experiments and to train them to analyze.

SYLLABUS:

List of experiments

(A minimum of 10 experiments must be conducted)

1. To study the cut models of IC engine.
2. To determine the load test on a single cylinder 4 stroke diesel engine (with rope brake dynamometer)
3. To study the actual valve timing diagram of 4 stroke diesel engine.
4. To determine the flash point & fire point of the diesel engine by means of the Cleveland apparatus.
5. To determine the calorific value of diesel by bomb calorimeter.
6. Experimental study on natural convention heat transfer
7. Experimental determination on Stefan Boltzmann constant.
8. Emissivity measurement of a radiating surface.
9. Thermal conductivity of a metal Rod
10. Experimental study on forced convection heat transfer
11. Measurement of unsteady state conduction heat transfer

COURSE OUTCOMES:

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

- Evaluate the performance characteristics of single cylinder diesel engine at different loads and draw the heat balance sheet.
- Know the actual valve timing diagram of 4 stroke diesel engine.
- Identify the flash point and fire point of the diesel engine by means of the Cleveland apparatus.
- Appreciate the practical ways to find calorific values of fuel.
- Perform the method of finding the thermal conductivity of material.

***REFERENCE BOOKS*:**

1. P.L Bellaney, Thermal Engineering, Khanna Publishers, 2010.
2. Obert, Internal Combustion Engines, McGraw Hill, 2008.
3. J. P. Holman, Heat Transfer, McGraw Hill, 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Laboratory practical, Record and Viva voce

30% - Test/s

10% - Attendance and Regularity in the class

University Examination Pattern *(Maximum Marks-100)*

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

20% - Viva voce

10% - Fair record

ME19 608 (P)	INSTRUMENTATION LAB	0-0-3-1

PRE-REQUISITE: Metrology and Instrumentation

COURSE OBJECTIVES:

- To provide knowledge of uncertainties involved in any measurement.
- To train the student in calibration and use of different measuring instruments.

SYLLABUS:

List of experiments

(A minimum of 10 experiments must be conducted)

1. Calibration of given vernier caliper using slip gauges.
2. Calibration of given screw gauge using slip gauges.
3. Measurement of roundness using V-block and dial test indicator.
4. Area measurement using planimeter.
5. Calibration of variable area flow meter (rotameter)
6. Measurement of groove angle of v block using vernier height gauge.
7. Calibration of linear variable differential transformer.
8. Calibration of pressure gauge using dead weight tester.
9. Calibration of thermocouple for temperature measurement.
10. Calibration of strain gauge load cell.

COURSE OUTCOMES:

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

- Do measurements using various instruments.
- Perceive expertise on various calibration methods.
- Perform area measurement using Planimeter.
- Evaluate the uncertainties involved in any measurement.
- Perform experiments on various displacement and pressure measurement devices.

REFERENCE BOOKS:

1. Jain R K, Engineering metrology, Khanna publishers, 21st Ed, 1984.
2. D S Kumar, Mechanical Measurements, Metropolitan Book Co (P) Ltd., 5th Ed, 2015.
3. I C Gupta, A text book of Engineering Metrology, Dhanpat Rai publications.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Laboratory practical, Record and Viva voce

30% - Test/s

10% - Attendance and Regularity in the class

Semester End Examination *(Maximum Marks-100)*

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

20% - Viva voce

10% - Fair record

ME19 701	INDUSTRIAL ENGINEERING AND SYSTEMS MANAGEMENT	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To enable students to understand industrial engineering and quality concepts.
- To understand the various components and functions of production planning and control such as work study.
- Introduce the students to the systems engineering process used to create multi-disciplinary solutions to complex problems.

SYLLABUS:

Module I: (12 hours)

Introduction to Industrial Engineering – Evolution of modern Concepts in Industrial Engineering – Functions of Industrial Engineering – Field of application of Industrial Engineering Product Development and research- Design function – Objectives of design, -

Manufacturing vs purchase- Economic aspects C-V-P analysis - Development of designs prototype, production and testing – Selection of materials and processes- Human factors in design- Value Engineering, Job plan. Introduction to Flexible manufacturing systems, Plant layout and Material handling- principles of material handling, Types of material handling equipments, Selection and application. Preventive and break down maintenance - Replacement of equipments- Method of providing for depreciation- Determination of economic life - Simple problems.

Module II: (10 hours)

Work Study; Historical background; Work study definition; Role of work study in improving productivity; Ergonomics and work study. Work study procedure: selection of jobs; Information collection and recording; Recording techniques -charts and diagrams; critical analysis; developing better method; installation and follow up of standard method.

Module III: (10 hours)

Motion Study: Memo motion and micromotion study; Therbligs; cycle graph and Chrono cycle graph; Simo chart; Principles of motion economy; Design of work place layout.

Work measurement: Definition; Procedure; Performance rating; Concept of normal time; allowances. Work sampling technique of work measurement. Introduction to pre -determined motion time system.

Module IV: (10 hours)

Quality & Reliability Introduction and definitions of quality Evolution of Quality: Inspection, Quality Control, Customer-Orientation: Internal & External Customer Concept, Life cycle approach to quality costs- Prevention; Appraisal and Failure costs. Seven QC tools (Histogram, Check sheets, Ishikawa diagrams, Pareto, Scatter diagrams, Control charts). Process capability concepts.

Module V: (10 hours)

Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.

Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.

COURSE OUTCOMES:

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

- Describe the scope, objectives, application, methods and tools of industrial engineering.
- Apply the various methods of method study to improve productivity
- Apply the various techniques of work measurement to Improve productivity
- Develop conceptual understanding of quality of product and process and its management
- Explain the functions, capabilities and limitations of systems engineering in the context of large developmental programs.

TEXT BOOKS:

1. O. P. Khanna, Industrial Engineering and Management, Dhanpat Rai Publications, 2018.
2. M Mahajan, Industrial Engineering and Production Management, Dhanpat Rai Publications, 2015.
3. Martand Telsang , Industrial Engineering & Production Management, S. Chand, 2006
4. Dr. B. Kumar, Industrial Engineering, Khanna publishers, 2004.

***REFERENCE BOOKS*:**

1. Ralph M. Barnes, Motion and Time Study Design and Measurement of Work, Wiley Publications, 7th Ed, 2009.
2. Eugene L. Grant, Richard S. Leavenworth, Statistical Quality Control, McGraw Hill, 7th Ed, 2006.
3. ES Buffa, Modern Production Operations management, Wiley Publications, 6th Ed, 1980.
4. Geneva Indian Adaptation International Labour Office, Introduction to work study, Oxford & IBH Publishing Co Pvt. Ltd, 2015.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 702	MACHINE DESIGN II	3-1-0-4

PRE-REQUISITE: Machine Design I

COURSE OBJECTIVES:

- To provide basic design skill with regard to clutches, brakes, belt drives, bearings, gears and connection rod.
- To understand the design modifications to be considered for the ease of manufacturing

SYLLABUS:

Module I: (12 hours)

Clutches and brakes: Friction clutches- design considerations- multiple disc clutches- cone clutch- centrifugal clutch- Brakes- Block brake- band brake – Band and Block brake.

Module II: (10 hours)

Belt and chain drives: materials for belts- slip of the belts- creep- centrifugal tension, Design of Flat belt drives, Design of V- belt drives- advantages and limitations, Selection of roller chains- galling of roller chains- polygonal action- silent chain.

Module III: (10 hours)

Rolling contact bearings: Types- Selection of bearing type- bearing life- static and dynamic load capacity- axial and radial loads- selection of bearings- dynamic equivalent load.
Sliding contact bearings: lubrication and lubricants- viscosity- journal bearings- hydrodynamic theory- design considerations- heat balance- bearing characteristic number- hydrostatic bearings.

Module IV: (10 hours)

Gear drives: Classification – gear nomenclature- tooth profiles- materials of gears- design of spur, helical, bevel gears and worm and worm wheel- Law of gearing- virtual or formative number of teeth- gear tooth failures- Beam strength- Lewis equation- Buckingham's equation for dynamic load- wear load- endurance strength of tooth- surface durability- heat dissipation- lubrication of gears- merits and demerits of each type of gears.

Module V: (10 hours)

Connecting rod: Material- connecting rod shank- small end- big end- connecting rod bolts- inertia bending stress.
Design Recommendations for forgings, castings and welded products- rolled sections- turned parts- screw machined products- parts produced on milling machines.

COURSE OUTCOMES:

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

- Design power transmission elements like clutches and brakes.
- Design belt drive and chain drive for power transmission.

- Select rolling contact bearings and design of sliding contact bearings.
- Carry out design of gear drives and understand the merits and demerits of different types of gears.
- Explain the design recommendations for the ease of manufacturing.

TEXT BOOKS:

1. J. E. Shigley, Mechanical Engineering Design, McGraw Hill Book Company, 9th Ed, 2011.
2. V. B. Bhandari, Design of Machine elements, McGraw Hill, 2016
3. M. F. Spotts, T. E. Shoup, Design of Machine Elements, Pearson Education, 8th Ed.

***REFERENCE BOOKS*:**

1. Juvinall R C, Marshek K. M., Fundamentals of Machine Component Design, John Wiley, 6th Ed, 2018.
2. S. Md. Jalaludeen, Machine Design, Anuradha Publications, 3rd Ed, 2006.
3. Doughtie V. I., Vallance A. V., Design of Machines, McGraw Hill Book Company, 4th Ed, 1964.
4. Siegel, Maleev & Hartman, Mechanical Design of Machines, International Book Company, 4th Ed, 1968.
5. James Baralla, Design for Manufacturability Handbook, McGraw Hill, 2nd Ed, 1998.

DATABOOKS PERMITTED FOR REFERENCE IN THE FINAL EXAMINATION:

1. PSG Design Data, DPV Printers, Coimbatore, 2020.
2. Narayana Iyengar B.R, Lingaiah K, Machine Design Data Handbook, Tata McGraw Hill/Suma Publications
3. K. Mahadevan, K. Balaveera Reddy, Design Databook, CBS Publishers & Distributors, 2nd Ed, 2019.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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 (*5x 20= 100*) *(Maximum Marks-100)*

There will be total of TEN questions - TWO questions from each module with choice to answer one question. Each main question carries 20 marks. This will enable to have the freedom of setting lengthy, design question or combination of short answer/problems/ essay/design in each main question.

ME19 703	MECHATRONICS	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To introduce the concept of mechatronics and the features of various sensors.
- To study in detail about pneumatic actuators and development of simple circuits.
- To impart the students a vivid idea about Process control pneumatics
- To study the applications of Mechatronics in Computer Numerical Control (CNC) machines
- To study the applications of Mechatronics in Robotics.

SYLLABUS:

Module I: (11 hours)

Introduction to Mechatronics: Structure of Mechatronics system. Sensors- Characteristics - Temperature, flow, pressure sensors. Displacement, position and proximity sensing by magnetic, optical, ultrasonic, inductive, capacitive and eddy current methods. Encoders: incremental and absolute, gray coded encoder. Resolvers and synchros. Piezoelectric sensors. Acoustic Emission sensors. Principle and types of vibration sensors.

Module II: (10 hours)

Actuators: Hydraulic and Pneumatic actuators - Directional control valves, pressure control valves, process control valves. Rotary actuators. Development of simple hydraulic and pneumatic circuits using standard Symbols

Module III: (11 hours)

Process control pneumatics- signals and standards - the flapper nozzle - volume booster – air relay and force balance - pneumatic controllers - proportional pneumatic control - proportional plus integral pneumatic control - proportional plus integral plus derivative pneumatic control - PI and IP convertors.

Module IV: (10 hours)

Mechatronics in Computer Numerical Control (CNC) machines: Machine structure: guide ways, drives. Bearings: anti-friction bearings, hydrostatic bearing and hydrodynamic bearing. Re-circulating ball screws, pre-loading methods. Re-circulating roller screws. Typical elements of open and closed loop control systems. Adaptive controllers for machine tools. Programmable Logic Controllers (PLC) –Basic structure, input/ output processing.

Module V: (10 hours)

System modeling - Mathematical models and basic building blocks of general mechanical, electrical and fluid systems.

Mechatronics in Robotics-Electrical drives: DC, AC, brushless, servo and stepper motors. Harmonic drive. Force and tactile sensors. Range finders: ultrasonic and light based range finders

COURSE OUTCOMES:

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

- Familiarize and explain about the principles of different types of sensors used in mechatronics systems.
- Explain about different components of hydraulic and pneumatic systems and to Design simple circuits using the components.
- Discuss about various elements used in Process control pneumatics
- Understand the use of Mechatronics in Computer Numerical Control (CNC) machines
- Understand the use of Mechatronics in Robotics.

TEXT BOOKS:

1. Bolton W., Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, Person Education Limited, New Delhi, 2007.
2. Ramachandran K. P., G. K. Vijayaraghavan, M. S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Wiley India Pvt. Ltd., New Delhi, 2008.
3. Saeed B. Niku, Introduction to Robotics: Analysis, Systems, Applications, Person Education, Inc., New Delhi, 2006.

***REFERENCE BOOKS*:**

1. David G. Aldatore, Michael B. Histand, Introduction to Mechatronics and Measurement Systems, McGraw-Hill Inc., USA, 2003.
2. Gordon M. Mair, Industrial Robotics, Prentice Hall International, UK, 1998.
3. HMT, Mechatronics, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
4. Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan, Smart Material Systems and MEMS: Design and Development Methodologies, John Wiley & Sons Ltd., England, 2006.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 704	ADVANCED AUTOMOBILE ENGINEERING	3-1-0-3

PRE-REQUISITE: Concepts of Mechanical Engineering

COURSE OBJECTIVES:

- To develop understanding about various automobile components and systems.
- To impart concepts of modern automotive controls.
- To know the recent developments in Automotive Technology and Trends.
- Familiarize with various developments and components with latest technologies used in Automobile Industry.

SYLLABUS:

Module I: (10 hours)

Engine and components, Chassis: Parts and functions, material and construction.
Modern fuel systems: Working and advantages of Petrol injection – MPFI, DI, CRDI, EDC.
Transmission: Clutch – functions and types - single plate, multi plate.

Module II: (11 hours)

Gear boxes: Functions and types - sliding mesh, constant mesh, synchromesh, semi-automatic and automatic transmission.
Propeller shaft –Hotchkiss drive –torque tube drive.
Differential: Functions and working, Front and rear axle, functions and classes.

Module III: (11 hours)

Brake System: Functions and classification –drum brake and disc brake – Mechanical brake, hydraulic brake, air brake, power assisted brake, regenerative brake, EBFD, Antilock braking system (ABS).
Wheel and Tyres – Pressed wheel, cast wheel and wire spoked wheel , Tyres – Types – tyre specification – tyre construction.

Module IV: (10 hours)

Steering system – Functions and components - Steering gear box types – Steering geometry.
Suspension system – objectives, Leafspring, Macpherson strut, torsion bar, hydraulic dampers.
Auto electric system –starter mechanism –solenoid switch – bendix drives. Functions and working of alternator

Module V: (10 hours)

Recent Trends in Automotive Power Plants: Electric and Hybrid Vehicle technology - LEV, TLEV, ULV and ZEV, Power systems and control systems.
Types of Engines - Stratified charged / lean burn engines – Hydrogen Engines-Introduction to fuel cells.

COURSE OUTCOMES:

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

- Understand the latest technology in fuel supply systems for IC engines.
- Explain the requirement of gearbox, propeller shaft and differential.
- Identify the braking system and wheels and Tyres used in a vehicle.
- Explain the steering and suspension system used in an automobile.
- Identify the recent trends in automotive power plants & alternative energy systems used for current conventional systems.

TEXT BOOKS:

1. Kripal Singh, Automobile Engineering –Vol. I and II, Standard Publishers Distributors, Delhi, 12th Edition, 2011.
2. Kamaraju Ramakrishna, Automobile Engineering, PHI Learning Private Ltd., 2012.
3. James D. Halderman, Automotive Technology, 4th edition, Pearson, 2013.
4. Barry Hollembeak, Automotive Electricity, Electronics and Computer Controls, Delmer Publishers, 1999.
5. Tom Denton, Automotive Electronics, Routledge, 2017.
6. Beranek. L. L., Noise Reduction, McGraw-Hill Book Co., Inc, New York, 1993.
7. Bosch Hand Book, 3rd Edition, SAE, 1993.
8. Seth Leitman, Bob Brant, Build Your Own Electric Vehicle, McGraw-Hill Education, 2013.

***REFERENCE BOOKS*:**

1. Bosh Automotive Hand Book, Bentley Publishers, 8th Edition, 2011.
2. G B S Narag, Automobile Engineering, Khanna Publishers, 12 th Edition, Delhi, 2005.
3. K. M Gupta , Automobile Engineering – Vol I and II , Umesh Publishers, 2007
4. R.K Rajput, A Text book of Automobile Engineering, Lakshmi Publications, 2nd Ed, 2017.
5. R.K singal , Automobile Engineering , S.K Kataria & Sons, 2013.
6. Donald E malen, Fundamental of Automotive Body Structure Design , SAE International, 2nd Ed, 2020.
7. Ronald K. Jurgen, Electric and Hybrid Electric Vehicles and Fuel Cell Technology, SAE, 2010.
8. Andrew Dicks and James Larminie, Fuel Cell Systems Explained, Wiley–Blackwell, 2000.
9. SAE, Fuel cells and alternative fuels / Energy systems
10. Rickard Stobart, Fuel Cell Technology for Vehicles, SAE, 2nd Ed, 2004.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 705(A)	INDUSTRIAL TRIBOLOGY	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide knowledge and importance of tribology in design, friction, wear and lubrication aspects in machine components.
- To understand the genesis of friction, the theories/laws of friction
- To learn about consequences of wear, wear mechanisms, wear theories and analysis of wear problems
- To understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.
- To understand the importance of adhesion property in different applications.
- To introduce the concept of surface engineering and its importance in tribology.

SYLLABUS:

Module I: (10 hours)

Introduction to Tribology: Tribology in Design, Tribology in Industry and Economic Aspects, Tribological Parameters- Friction, Wear and Lubrication- The Topography of Engineering Surface - Contact between Surfaces.
Bearing: Types of Bearings, Comparison of Sliding and Rolling Contact Bearings.

Module II: (10 hours)

Friction: Introduction - Empirical Laws of Friction - Kinds of Friction - Causes of Friction - Theories of Friction - Measurement of Friction -Friction of Metals, Ceramic Materials and Polymers - Rolling Friction - Laws of Rolling Friction - Relation Between Temperature and Friction - Stick-Slip, Prevention of Stick-Slip - Consequences of Friction.

Module III: (10 hours)

Wear: Introduction - Types of Wear –Adhesive wear - abrasive wear – fatigue and corrosive wear -Various Factors Affecting Wear - Theories of Wear - Wear Mechanisms – wear analysis - Measurement of Wear - Wear Regime Maps - Alternative Form of Wear Equations - Lubricated and Unlubricated Wear of Metals - Materials Used in Different Wear Situations.

Module IV: (10 hours)

Lubrication: Importance of lubrication - Principle and Application - Hydrodynamic Lubrication, Elastohydrodynamic Lubrication, Boundary Lubrication and Solid Lubrication.
Lubricants: Types of Lubricants, Properties of Lubricants - Effect of Speed and Load on Lubrication, Frictional Polymers
Lubrication in Metal Working: Rolling, Forging, Drawing and Extrusion.

Module V: (12 hours)

Adhesion: Introduction, Adhesion Effect by Surface Tension, Purely Normal Contact and Compression plus Shear -Adhesion in Magnetic Recording Systems -Dependence of Adhesion on Material and Geometric Properties

Bearing Materials: Introduction, Rolling Bearing, Fluid Film Lubricated Bearing, Dry Bearing, Bearing Constructions.

Surface Engineering: Introduction to Surface Engineering- Concept and Scope of Surface Engineering - Surface Modification – Transformation Hardening, Surface Melting, Thermo chemical Processes - Surface Coating - Selection of Coating for Wear and Corrosion Resistance - Potential Properties and Parameters of Coating.

COURSE OUTCOMES:

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

- Generalise the significance of tribology in industry and economic aspects
- Elucidate the theories/laws of sliding and rolling friction and the effect of viscosity.
- Classify different types of wear, wear mechanisms and analysis of wear problems.
- Get an exposure to theories of hydrodynamic and the advanced lubrication techniques and the application of lubrications in metal working.
- Gain an overview of the adhesion property in different applications and outline the basics of surface engineering and surface coating techniques.

TEXT BOOKS:

1. Ernest Rabinowicz, Friction and wear of materials, John Wiley & sons, 1995.
2. I M Hutching, Tribology: Friction and wear of engineering materials, Butterworth-Heinemann, 1992.
3. Prasanta Sahoo, Engineering Tribolog, PHI Learning Pvt Ltd, New Delhi, 2011.

***REFERENCE BOOKS*:**

1. B. Bhushan, Introduction to Tribology, John Wiley & Sons, Inc, New York, 2002.
2. B.Bhushan, B.K. Gupta, Handbook of tribology: materials, coatings and surface treatments", McGraw-Hill, 1997.
3. Halling J, "Principles of Tribology", McMillan Press Ltd., 1978.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 705(B)	ACOUSTICS AND NOISE CONTROL	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To understand the science of acoustic wave propagation.
- To give practical engineering applications and understanding of how noise is quantified, how it is produced etc.
- To provide exposure on interesting and practical applications such as musical Instruments, architectural acoustics (of concert halls), design of partitions etc.
- To introduce the government regulations on acceptable noise levels, underwater acoustics, etc.

SYLLABUS:

Module I: Basics of Acoustics and Vibration (8 hours)

Introduction, frequency, Fourier series, FFT, loudness, decibel scale, octave, music scale. Vibration of one degree of freedom system. Brief introduction to multi degree of freedom system.

Environmental and Architectural acoustics - Sound in enclosure, reverberation time, sound absorption materials, acoustics factors in architectural design. Speech interference, noise rating curves, highway noise, design of partitions.

Module II: Vibration of string, bars, membranes and plates (12 hours)

One dimensional wave equation, general solution of wave equation, plucked string. Longitudinal vibration of bars, transverse vibration of beam. Wave equation for stretched membrane, normal modes of membrane. Vibration of plates.

Machine Noise- Noise generation by bearing, gears motors, fans propellers, generator sets, cooling, pump sets, pipe, etc.

Module III: Acoustic wave equation and its solution (10 hours)

Equation of state, continuity, Euler's equation. Linear wave equation, speed of sound in fluids. Acoustic intensity, specific acoustic impedance, spherical waves, cylindrical waves. Waveguides, transmission line equations and resonators.

Module IV: Reflection and transmission (10 hours)

Changes in media, transmission from one fluid to another – normal and oblique incidence. Normal specific acoustic impedance, reflection from solid. Transmission through thin partition – mass law. Perfectly matched layer.

Special topics - Underwater acoustics, shock waves and explosion. (Can be in the form of seminars/presentation)

Module V: Radiation and reception of acoustic waves (12 hours)

Radiation from pulsating sphere, acoustic reciprocity, continuous line source, radiation from circular piston, radiation impedance. Models of electromechanical acoustic systems, Solution for a loudspeaker model, Microphones.

Noise Control: Noise ratings and standards, human tolerance levels, equivalent sound level and loudness contours – Engine and muffler designs – Noise control through barriers and enclosures and absorbent linings – Vehicular noise and control – Environmental noise control.

COURSE OUTCOMES:

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

- Describe the architecture and environmental inclusive of reverberation and noise.
- Provide mathematical basis for acoustics waves.
- Give a detailed study on loud speakers and microphones.
- Apply engineering and other methods for controlling exposure to noise and vibration.
- Identify and use appropriate formulae to calculate sound levels in enclosed spaces and outdoors.

TEXT BOOKS:

1. Fundamentals of Acoustics, Lawrence E. Kinsler, Austin R. Frey, 4th Ed., Wiley Publishers, 2000.
2. Noise and Vibration Control, Munjal M. L., World Scientific Publishers in Collaboration with IISc Press, Singapore, 2013.

***REFERENCE BOOKS*:**

1. Acoustics, Beranek Leo L., McGraw-Hill, Acoustical Society of America, NY 11797, 1996.
2. E. G. Williams, Fourier Acoustics: Sound Radiation and Near Field Acoustic Holography, Academic Press: New York, 1999.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 705(C)	TECHNOLOGY MANAGEMENT	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To expose the students the concept of technology management, nuances and issues in technology management and the decision making related to technology management.
- To acquaint the students with the role of technology and innovation in global industrial competition with latest trends and developments.

SYLLABUS:

Module I: (8 hours)

Introduction to Technology Management: Technology and Technology Management-Evolution and Growth of Technology, Role and Significance of Technology Management, Impact of Technology on Society and Business- Technology and competition; Key issues in managing technological innovation, Forms of Technology- Process technology; Product technology.

Module II: (10 hours)

Technology Acquisition and Technology Forecasting: Technology Acquisition, Alternatives for Acquiring New Technologies, New Technology, Management of Acquired Technology, Measures of Scale and Mechanisms for Acquiring Technologies-Economy of scale or Scale economy; Levels of scale; The measurement of scale; Factors affecting the choice of scale, Technology Forecasting: Characteristics of technology forecasting ; Technology forecast method; Principles of technology forecasting, Technology Forecasting Process, Need and Role of Technology Forecasting, Forecasting Methods and Techniques, Planning and Forecasting.

Module III: (10 hours)

Technology Strategy, Technology Adoption, Diffusion and Absorption and Competitiveness: Technology Strategy-Technology strategy and management; Elements of technology strategy, Innovation Management, Competitive Advantage- Components of competitive advantage; Creating competitive advantage using value chain, Technology Management Evaluation or Assessment, Technology Adoption, Diffusion, and Absorption: Technology Adoption, Technology Diffusion- Perspectives of innovation diffusion process, Technology Absorption-Role of technology absorption; Benefits of technology absorption; Constraints in technology absorption, Technology Package and Technological Dependence, Indian Experience in Technology Absorption Efforts, Issues Involved in the Management of Technology Absorption and Government Initiatives.

Module IV: (14 hours)

Technology Generation and Development: Technology Generation- Process; , Technology Development, Importance of Technology Generation and Development, Need for

Technology Strategy, Importance of Research and Development (R&D)- Corporate research and product lifetimes; Production costs and R&D; Translation of R & D efforts to technology, Technology Transfer: Transfer of Technology, Models of Technology Transfer- Traditional technology transfer models; Qualitative technology transfer models, Technology Transfer Modes, Dimensions of Technology Transfer, Features of Technology Package, Routes of Technology Transfer, Technology Assessment: Technology Choice, Technology Assessment Process, Technology Leadership and Followership, Technology Concepts- Technology acquisition; Meaning of innovation and creativity; Innovation management.

Module V: (10 hours)

Human Aspects in Technology Management: Integration of People and Technology, Factors Considered in Technology Management-Organisational factors; Psychological factors, Organisational Structure and Technology, Social Issues in Technology Management: Social Issues, Technological Change and Industrial Relations- Implementation of rationalization and automation in India; Impact of technological change, Technology Assessment and Environmental Impact Analysis- Environmental impact analysis process- Guidelines on the scope of EIA; Issues in preparation of EIA report; Elements of the environmental problem.

COURSE OUTCOMES:

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

- Gain a fair understanding on contemporary topics in technology and innovation management.
- Assess the range, scope, and complexity of the phenomena, issues, and problems related to technology management.
- Use a range of tools used in technology creation, search, assessment, selection, implementation, utilization, and strategy.
- Discuss various problems where particular managerial decisions need to be taken such as technology acquisition and transfer.
- Get an idea on technical, human and social aspects of technology management.

TEXT BOOKS:

1. P N Rastogi, Management of Technology and Innovation: Competing Through Technological Excellence, (Kindle Edition), SAGE Publications, Response Books. 2009.
2. Tushman, M.L. and Anderson ,P. Managing Strategic Innovation & Change, New York: Oxford University Press, 2004.
3. Khurana, V. K., Management of Technology and Innovation, New Delhi: Ane Books, 2012.

***REFERENCE BOOKS*:**

1. Narayanan, V. K, Managing Technology and Innovation for Competitive Advantage, Pearson Education, 2002.
2. Ettile, J. E, Managing Innovation: New technology, New Products and New Services in a Global Economy, A Butterworth-Heinemann Title, 2006.

3. Afuah, A. Innovation Management, Strategies, Implementation and Profits, Oxford University Press, 2009.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 705(D)	MICRO AND NANO MANUFACTURING	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To give awareness of different techniques used in micro and nano manufacturing
- To give in-depth idea of the conventional techniques used in micro manufacturing
- To introduce Non-conventional micro-nano manufacturing and finishing approaches
- To introduce Micro and Nanofabrication Techniques and other processing routes in Micro and nano manufacturing
- To know different techniques used in Micro Joining and the metrology tools in micro and nano manufacturing

SYLLABUS:

Module I: (11 hours)

Introduction to Precision engineering, macro milling and micro drilling, Micro-electromechanical systems – merits and applications, Micro phenomenon in Electro-photography – applications. Introduction to Bulk micromachining, Surface micromachining steps, Micro instrumentation – applications, Micro Mechatronics, Nano finishing – finishing operations. Laser technology in micro manufacturing- Practical Lasers. Introduction to Micro-energy and chemical system (MECS), Space Micro-propulsion, e-Beam Nanolithography – important techniques, Introduction to Nanotechnology.

Module II: (10 hours)

Introduction to mechanical micromachining, Micro drilling –process, tools and applications Micro turning- process, tools and applications, Diamond Micro turning – process, tools and applications Micro milling and Micro grinding – process, tools and applications Micro extrusion- process and applications micro bending with Laser Nano- Plastic forming and Roller Imprinting.

Module III: (11 hours)

Introduction to Non-conventional micro-nano manufacturing Process, principle and applications – Abrasive Jet Micro Machining, WAJMM Micro EDM, Micro WEDM, Micro EBM – Process principle, description and applications Micro ECM, Micro LBM - Process principle, description and applications Focused ion beams - Principle and applications.

Module IV: (10 hours)

Introduction to Micro and Nano Finishing Processes Magnetorheological Finishing (MRF) processes, Magnetorheological abrasive flow finishing processes (MRAFF)– process principle and applications Force analysis of MRAFF process, Magnetorheological Jet finishing processes Working principle and polishing performance of MR Jet Machine Elastic Emission Machining (EEM) – machine description, applications.

Module V: (10 hours)

Laser Micro welding – description and applications, Defects Electron Beam Micro-welding – description and applications. Introduction to micro and nano measurement, defining the scale, uncertainty. Scanning Electron Microscopy – description, principle. Scanning White-light Interferometry – Principle and application Optical Microscopy – description, application. Scanning Probe Microscopy, scanning tunneling microscopy description, application.

COURSE OUTCOMES:

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

- List out the different techniques used in micro and nano manufacturing.
- Discuss the conventional techniques used in micro manufacturing.
- Discuss about non-conventional micro-nano manufacturing and finishing approaches.
- Identify and explain the principle behind different micro and nano finishing processes.
- Compare the different micro welding processes and to understand the fundamentals of micro and nano measurements

TEXT BOOKS:

1. Mark. J. Jackson, Micro-fabrication and Nano-manufacturing - Pulsed water drop micromachining CRC Press 2006.
2. Nitaigour Premchand Mahalik, Micro-manufacturing and Nanotechnology, 2006.

***REFERENCE BOOKS*:**

1. Mark. J. Jackson, Micro and Nano-manufacturing, Springer, 2006.
2. V K Jain, Micro-manufacturing Processes, CRC Press, 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 705(E)	HEAT TRANSFER EQUIPMENT DESIGN	3-1-0-3

PRE-REQUISITE: Heat and Mass Transfer

COURSE OBJECTIVES:

- To impart the concepts of design of heat transfer equipment's.
- To develop understanding about design of Double pipe Heat exchanger.
- To develop understanding about design of shell and tube Heat exchanger.
- To develop understanding about design of Compact Heat exchanger.
- To develop understanding about Design and analyze the cooling towers.

SYLLABUS:

Module I: Classification and basic design methodologies (8 hours)

Heat exchangers – classification of Heat exchangers – selection of Heat exchangers – heat transfer and flow friction characteristics – pressure drop analysis – basic thermal design – theory of heat exchangers – E-NTU, P-NTU and MTD method - F-factor for various configurations - applications to design.

Module II: Design of double pipe heat exchanger (10 hours)

Thermal design of double pipe heat exchanger – design of air-cooled heat exchanger – design variables, preliminary sizing – heat transfer and pressure loss calculations – detailed design. Thermal design of regenerators – classifications – governing equations – design parameters.

Module III: Design of Shell and tube heat exchangers (12 hours)

Design of Shell and tube heat exchanger – construction and thermal features – thermal design procedure – kern method – Bell Delaware method – flow stream analysis method – flow induced vibration in shell and tube heat exchanger.

Module IV: Design of compact heat exchangers (12 hours)

Design of compact heat exchangers – plate and fin, fin-tube and plate and frame heat exchangers – fouling and corrosion in heat exchanger – sizing and cost estimation of heat exchanger.

Module V: Direct Contact Heat Exchanger (10 hours)

Cooling towers- relation between wet bulb & dew point temperatures - the Lewis number - classification of cooling towers - cooling tower internals and the roll of fill - heat transfer by simultaneous diffusion and convection. Analysis of cooling tower requirements - Design of cooling towers - Determination of the number of diffusion units - calculation of cooling tower performance.

COURSE OUTCOMES:

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

- Identify the influencing/affecting parameters for various heat transfer equipment's.
- Design double pipe, compact heat exchanger
- Design shell and tube heat exchanger
- Measure the performance degradation of heat exchangers subject to fouling
- Classify cooling towers and explain their technical features

TEXT BOOKS:

1. G. F. Hewitt, George L. Shires, T. R. Bott, Process Heat Transfer, CRC Press, 1994.
2. Saunders, Heat Exchanger – selection, design and construction, Longman Scientific and Technical, U. K.
3. I A Gurney, J D Cotter, Cooling Towers, Maclaren Publisher, 1966.

***REFERENCE BOOKS*:**

1. R. K. Shah, Fundamental of Heat Exchanger Design, John Wiley & Sons, 2003.
2. Donald Q. Kern, Process Heat Transfer,Tata McGraw –Hill Edition, 1997.
3. S K Das, Process Heat Transfer, Narosa Publication, 2009.
4. Heat Exchanger Design Hand Book: Volumes 2 and 3, edited by Ernst U Schlunder. et. al Hemisphere Publishing Co., 1983.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 705(F)	HEATING VENTILATION AND AIR-CONDITIONING SYSTEM	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To learn fundamentals of HVAC information such as how the machines work and the parts are required for installation and repair.
- To impart knowledge on principles of refrigeration, cooling and heating load calculation, design of air conditioning system and selected systems in comfort engineering
- To design Duct and other heating systems in Air-conditioning.
- To design the ventilation and Evaporative Loss calculation in cooling towers.

SYLLABUS:

Module I: (10 hours)

Introduction to HVAC - Fundamental and scope of HVAC, Mode of heat transfer, Standards, Refrigeration cycle, Component of A/C, Refrigerants and types. Classification of Air-Conditioning System - Window Air Conditioning Systems. , Split Air Conditioning Systems, Central Air Conditioning Systems, Package Air Conditioning Systems.

Module II: (11 hours)

Fundamental and scope of HVAC - Air cooled system of air conditioning, Chilled water system of air conditioning, Air water system of air conditioning, Direct refrigerant system of air conditioning.
Study of Psychrometry - Psychrometric properties and processes, Psychrometric chart, various process-sensible cooling and heating, adiabatic saturation, Heating and humidification, cooling and dehumidification, mixing of air streams, various process - S.H.F, G.S.H.F, E.S.H.F Etc.

Module III: (11 hours)

Load Calculation - Orientation of Building, To Read Latitude of Location of building, Calculation of U factor for wall, glass, Roof and Partition, Calculation of Equivalent Temp. , Difference for wall, glass, Roof and Partition, Cooling and Heat Load Calculation using ASHRAE Standards, Calculation Of sensible Heat Factor, ADP and Dehumidified CFM.

Module IV: (10 hours)

Design of air conditioning system - Duct design - pressure drop in ducts, pressure drop by graphical method- method of duct design- Arrangements of ducts, fan design, thermal insulation.
Heating systems-warm air systems-hot water systems steam heating systems-panel and central heating systems heat pump circuit. Automobile and Train car air conditioning.

Module V: (10 hours)

Ventilation and Fresh Air - Ventilation, Infiltration load calculations. Restaurant and residence kitchen ventilation system design, Parking area ventilation and designing. Toilet ventilation (Industrial and residential), Evaporative Losses calculation in cooling towers.

COURSE OUTCOMES:

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

- Analyze simple conduction/convection heat transfer models through composite walls and apply the concepts of environmental comfort to HVAC systems.
- Describe the components of central air systems & analyze, compare different central air systems and also science of psychrometrics.
- Calculate the requirements for proper indoor air quality and design and analyze duct systems paying attention to appropriate air velocities.
- Analyze and compare different heating systems and understand the Automobile/ Train car AC systems.
- Design and analyze various ventilation systems.

TEXT BOOKS:

1. Faye C McQuiston, Jerald D Parker, Jeffrey D Spitler, Heating, ventilating, and air conditioning: analysis and design, John Wiley & Sons, 2005.
2. Thomas H. Kuehn, James W. Ramsey, James L. Threlkeld, “Thermal environmental engineering”, Prentice Hall, 1998.
3. Handbook of air conditioning and refrigeration, Shan K. Wang, Second Edition, McGraw-Hill, 2000.
4. V Ganeshan Internal combustion engines, Mc-Graw-Hill, 4th Ed, 2012.

***REFERENCE BOOKS*:**

1. C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill, 2nd Ed, 2000.
2. Manohar Prasad, Refrigeration and Air Conditioning, New Age International, 2011.
3. W. P. Jones, Air-conditioning Engineering, Routledge publishers, 5th Ed, 2020.
4. Carriers Handbook system design of Air Conditioning, Tata McGraw Hill, 2003.
5. R. G. Jordan, G. B. Priester, Refrigeration and Air conditioning, Prentice hall, 1st Ed, 1948.

Note: Students are permitted to refer refrigeration charts / Steam tables for the University examination.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 706 (P)	CAD/CAM LAB	0-0-3-1

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide basic understanding of various software's for solid modelling and analysis.
- To give practice on Solid Modeling using Solid Modelling software's.
- To provide training on analysis works using analysis software's.

SYLLABUS:

Introduction

- Computer Aided Design.
- Finite Element Method Software's.

List of experiments

1. 2D drawing using CAD software. (minimum 3 drawings)
2. Solid modelling of various mechanical elements such as gears, shafts, screws etc. (minimum 3 drawings)
3. Assembling of various mechanical systems such as shaft couplings, Nut and Bolt, riveted joints etc. (minimum 3 drawings)
4. Analysis of various mechanical systems using Finite Element Method Software's.
5. Structural Analysis. (minimum 2)
6. Thermal Analysis. (minimum 2)
7. Fluid Flow Analysis. (minimum 2)
8. Simulations of various machining operations using CNC simulation software's.

COURSE OUTCOMES:

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

- Draft 2D drawings strictly complying with industrial standards.
- Develop solid models of various mechanical systems and assemble them.
- Analyse and interpret mechanical systems using Analysis software's.
- Minimise material wastage by simulating machining operations using CNC Simulation software's.
- Optimize machining parameters for efficient machining.

***REFERENCE BOOKS*:**

1. Daryl Logan, A First course in Finite Element Method, Thomson Learning, 2010.
2. Ibrahim Zeid, CAD/ CAM Theory and Practice, McGraw Hill, 2007.
3. T. R. Chandrupatla and A. D. Belagundu, Introduction to Finite Elements in Engineering, Pearson Education, 2012.
4. Mikell P. Groover and Emory W. Zimmer, CAD/ CAM – Computer aided design and manufacturing, Pearson Education, 2008.
5. David V Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill, 2003.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Laboratory practical, Record and Viva voce

30% - Test/s

10% - Attendance and Regularity in the class

University Examination Pattern *(Maximum Marks-100)*

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

20% - Viva voce

10% - Fair record

ME19 707 (P)	THERMAL ENGINEERING LAB II	0-0-3-1

PRE-REQUISITE: Thermal Engineering

COURSE OBJECTIVES:

- Understand the basic principles in the areas of internal combustion engines and Refrigeration systems.
- To conduct the performance test on IC engines, compressors and blowers.
- Analyse automobile exhaust gas.

SYLLABUS:

List of experiments

(A minimum of 10 experiments must be conducted)

1. Heat Balance Test on 4 –stroke Diesel Engine
2. Effectiveness of Parallel/counter flow heat exchanger
3. Performance studies on shell and tube heat exchanger
4. Performance test on single/two stage reciprocating air compressor
5. Determination of COP of a refrigeration system
6. Performance test on centrifugal blower
7. Performance test on air conditioning system
8. Morse Test on Multi-cylinder Petrol Engine
9. Analysis of automobile exhaust gas and flue gas using exhaust gas analyser
10. Determination volumetric efficiency and Air-fuel ratio of IC engines

COURSE OUTCOME:

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

- Calculate & Compare the performance characteristics.
- Apply the concept of Morse test on SI engine.(multi cylinder).
- Analyse the efficiency of reciprocating air compressor and blower.
- Conduct performance test on air conditioning system.
- Find Effectiveness of heat exchangers.

REFERENCE BOOKS:

1. P.L Bellaney, Thermal Engineering, Khanna Publishers, 2010.
2. Obert, Internal Combustion Engines, McGraw Hill, 2008.
3. J. P. Holman, Heat Transfer, McGraw Hill, 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Laboratory practical, Record and Viva voce

30% - Test/s

10% - Attendance and Regularity in the class

Semester End Examination *(Maximum Marks-100)*

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

20% - Viva voce

10% - Fair record

ME19 708 (P)	PROJECT PHASE I	0-0-4-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To enable the students to apply the engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.

SYLLABUS:

Project work is for duration of two semesters and is expected to be completed in the eighth semester. 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. Each student group consisting of not more than four members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. Project evaluation committee consisting of the HOD or a senior faculty member, guide and three/four faculty members specialized in the above field shall perform the screening and evaluation of the projects.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent. Literature survey and 40% of the work has to be completed in the seventh semester.

Students should execute the project work using the facilities of the institute. However, external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

Each student has to submit an interim report of the project at the end of the 7^{th} semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7^{th} semester.

COURSE OUTCOMES:

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

- Identify a topic of interest and use acquired knowledge within the selected area of technology for project development.
- Discuss and justify the technical aspects and design aspects of the project with a systematic approach.
- Analyze the technical aspects and design aspects of the project and propose a work plan
- Practice team dynamics to work effectively in a team for the development of

technical projects.

- Develop skills in technical presentation and report preparation.

Assessment Pattern

The Evaluation will be conducted as an internal evaluation based on the work done, the report and a viva- voce examination, conducted by a Project evaluation committee appointed by Head of the Department. The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systems under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest /problem domain or conduct open brain storming sessions for developing innovative ideas. Zeroth review will not be a part of the evaluation process.

Internal Continuous Assessment *(Maximum Marks-100, Minimum required to pass-50)*

30% - Project Guide

20% - Interim evaluation by the evaluation committee

30% - Final presentation

20% - Report evaluation by the evaluation committee

ME19 709 (P)	INTERNSHIP	0-0-0-1

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To become acquainted with the future field of the mechanical engineering student
- To apply the acquired knowledge and skills in a practical situation
- To become acquainted with real life problem solving

SYLLABUS:

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. The Internship should give exposure to the practical aspects of the relevant course/branch and allied engineering discipline. 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/systems 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.

COURSE OUTCOMES:

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

- Identify how the internship relates to their academic courses and preferred career path.
- Communicate in a workplace environment in a clear and confident manner.
- Evaluate performance and accept feedback, in order to make changes as necessary.
- Articulate their experience and skills to potential employers.
- Identify and articulate next steps in their career trajectory.

Internal Continuous Assessment *(Maximum Marks-100, Minimum required to pass-50)*

10% - Attendance

20% - Coordinator

30% - Technical content of the report

40% - Presentation

ME19 801	COMPUTER INTEGRATED MANUFACTURING	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To understand how computers are integrated at various levels of planning, manufacturing and inspection.
- To impart fundamental knowledge of Numerical Control, NC part programming, Controls in CIM, material handling systems.
- To acquire comprehensive idea on FMS and Robotics.

SYLLABUS:

Module I: (10 hours)

Application of computer for design and manufacturing. Integration of CAD/CAM- Manufacturing Systems- Elements of Computer Integrated Manufacturing (CIM), CIM wheel, CIM components, various activities in CIM, Benefits of CIM. Principles of Sequential and Concurrent engineering –Techniques of Concurrent Engineering. Product life cycle management. CIM database and database management systems- Data base requirements of CIM, Features of database management system, DBMS architecture.

Module II: (10 hours)

Introduction to CAM – basic components of NC system, NC motion control system, applications of NC, advantages and disadvantages of NC. Computer Numerical control (CNC system), advantages of CNC, functions of CNC, Features of CNC systems - Open loop and Closed loop systems- Absolute and incremental, preparatory and miscellaneous codes, interpolation and canned cycle, tool compensation. Simple turning and drilling programs. Direct Numerical Control (DNC system), components of a DNC system, functions of DNC, advantages of DNC.

Module III: (11 hours)

Material handling in CIM- AGV- Vehicle guidance- vehicle management and safety automated storage systems- ASRS components and operations- features of ASRS- automatic data capture- barcode technology- magnetic strips- optical character recognition-Group Technology- part family- part classification and coding - features OPITZ classification and multi class coding system. Computer Aided Process Planning (CAPP) – Retrieval and regenerative approaches, benefits.

Module IV: (10 hours)

Flexible manufacturing system- types of FMS- components of FMS- FMS workstations- FMS layout- Benefits of FMS- Industrial robotics- robot anatomy- configurations- Joints- drive systems- Robot control systems- End effectors- Sensors in robots- Industrial robot applications- Robot Programming- Resolution, accuracy and repeatability.

Module V: (11 hours)

Computer Aided Inspection (CAI) and Testing (CAT) – Effects of implementing CAI and CAT. Non-contact optical methods for CAI –Machine vision, scanning laser beam, photogrammetry. Coordinate Measuring Machine (CMM) – Working and configurations of contact and non-contact CMMs.

COURSE OUTCOMES:

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

- Interpret the various aspects of computer integration in manufacturing and to describe the integration of manufacturing activities into a complete system.
- Describe the NC and CNC systems used in manufacturing and also to generate CNC part programs by using Preparatory and Miscellaneous codes.
- Obtain an overview of computer technologies including computers, database and data collection, networks, machine control, etc., as they apply to factory management and factory floor operations.
- Recognize use of robotics, in the field of manufacturing.
- Plan the inspection and testing for various industrial products.

TEXT BOOKS:

1. Mikell P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, Pearson Education, Inc., 2001.
2. Mikell P. Groover, Industrial Robotics, Prentice-Hall of India, 2001.
3. Andreas Gebhardt, Rapid Prototyping, Carl Hanser – Verlag, Munich, 2003.

***REFERENCE BOOKS*:**

1. A. Alavudeen, N. Venkateteshwaran, Computer Integrated Manufacturing, PHI Learning Private Limited, 2013
2. Mikell P. Groover, CAD/CAM, Prentice-Hall of India, New Delhi, 2005.
3. P. Radhakrishnan, S. Subramanian, V. Raju, CAD/CAM/CIM, New Age Int., 2009.
4. Xun Xu, Integrating Advanced Computer-Aided Design, Manufacturing and Numerical Control: Principles and Implementations, Information Science Reference, USA 2009
5. John A. Bosch, Coordinate Measuring machine and Systems, Marcel Dekker, Inc., New York 1995.
6. D. T. Pham, S.S. Dimov, Rapid Manufacturing-The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer – Verlag, London, 2001.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 802	OPERATIONS MANAGEMENT	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To equip with elementary knowledge of aspects of Production and Operations management for application in functions such as Product Design, Production Planning and Control
- To impart knowledge on production, planning and control functions, method study, materials management, inventory models, maintenance management and project management

SYLLABUS:

Module I: (10 hours)

Operations Management – An overview: Nature and scope of production and Operations Management – Types of production systems; Continuous Flow, Mass, Batch, Job shop - Productivity and factors affecting productivity - Strategic Management: Mission, Objectives, Corporate Strategies, Business unit strategies, Functional Strategies - Forecasting models - Simple moving average, weighted moving average, Exponential smoothing, Linear regression- Delphi technique.

Module II: (11 hours)

Product Life Cycle, New product Development ; Steps in product Design, Value Analysis/Engineering, Standardisation, simplification, Make or buy Decision, Ergonomic Consideration in Product Design, Product Mix Decisions - Facility Location – Factors affecting Site Selection, Single and Multi Facility Location, Minimax Location, Gravity Location (simple problems)– Plant Layout – types of Layout – Product, Process, Mixed, Project, Cellular, Flexible Manufacturing, Group Technology, Material Handling, Assembly Line Balancing.

Module III: (11 hours)

Aggregate production planning – Master production scheduling – Determination of Economic batch quantity (simple problems)- Material Requirement Planning (MRP), Bill of Materials, Inventory Mangement – Order quantity, Lead Time, Safety stock, Reorder point, Deterministic and Probabilistic Inventory models – Quantity discount- Determination of Economic Order Quantity (Simple problems), Inventory control – ABC, VED analyses

Module IV: (10 hours)

Materials Management: Purchase Management- Stores Management - scheduling: Strategy and guidelines – charts and methods – Sequencing – Johnson’s rules for sequencing Dispatching, progress reporting and expediting functions - Manufacturing Resources Planning (MRP II).

Module V: (10 hours)

Maintenance and replacement – Preventive and breakdown maintenance – Economic aspects – Replacement of equipment – methods - Network techniques for Project management- CPM, PERT – Time estimates – Time- Cost trade offs- Crashing – Shortest route problem – Minimal Spanning tree problem.

COURSE OUTCOMES:

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

- Infer suitable demand forecasting models and production systems
- Explain aspects of Product Design & Development and to summarize factors related to facility location and plant layout
- Understand the roles of inventories and basics of managing inventories in various demand settings.
- Exemplify MRP & scheduling techniques for simple applications
- Use various Network techniques for managing projects.

TEXT BOOKS:

1. R Panneerselvam, Production and Operations Management: Prentice-Hall of India Pvt. Ltd, 3rd Ed.
2. Mahadevan B. Operations Management Theory and Practice, Pearson education, Second impression 2007.
3. M S Mahajan Industrial engineering and Production management: Dhanpat Rai & Co. (P) Ltd, 2015.
4. N G Nair Production and Operations Management: Tata McGraw Hill Publishing Co. Ltd, 2009.
5. P Rama Murthy Production and Operations Management: New Age International (P) Ltd. Publishers, 2012.
6. William, J. Stevenson, Operations Management, McGraw-Hill Education, 8th Ed, 2005.

***REFERENCE BOOKS*:**

1. S N Chary Production and Operations Management: Tata McGraw Hill Publishing Co. Ltd, 2008.
2. Harding H. A. Production management, Macdonald and Evans, 1970.
3. Mayer, R. R. Production management, McGraw-Hill, 1968.
4. Ashwathappa. K, Sridhar Bhat. K, Production and Operations Management, Himalaya Publications, 2012.
5. Joseph G Monks, Operations Management, McGraw hill, 2011
6. Riggs J.L, Economic Decision Models for Engineers and Managers, McGraw Hill International Student Edition, 1968.
7. J D Weist, F K Levy, A Managemnt Guide to Pert and CPM, Prentice Hall of India, 1979.
8. Samuel Eilon, Production Planning and Control, Universal Book Corporation, 2015.
9. John E. Biegel, Production Control, Prentice Hall of India, 1971.

10. James Moore, Plant Layout and Design, Collier MacMillan Company, 1962.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 803(A)	NON-DESTRUCTIVE TESTING	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To introduce the basic principles, techniques, equipment, applications and limitations of NDT methods such as Visual, Penetrant Testing, Magnetic Particle Testing, Ultrasonic Testing, Radiography, Eddy Current.
- To enable selection of appropriate NDT methods.
- To identify advantages and limitations of non-destructive testing methods
- To make aware the developments and future trends in NDT.
- To differentiate between Destructive and NDT

SYLLABUS:

Module I: (12 hours)

Introduction to NDT- Comparison between destructive and NDT, Importance of NDT, Scope of NDT, difficulties of NDT, future progress in NDT, economics aspects of NDT.
Visual Inspection - tools, applications and limitations - Fundamentals of visual testing: vision, lighting, material attributes, environmental factors. Visual perception, direct and indirect methods mirrors, magnifiers, borescopes, fiberscopes, closed circuit television, light sources, special lighting, a system, computer enhanced system
Liquid Penetrant Inspection: principles, properties required for a good penetrants and developers - Types of penetrants and developers, Liquid Penetrant Inspection: principles, properties required for a good penetrants and developers - Types of penetrants and developers, interpretation and evaluation of penetrant test indications, false indication, safety precaution required in LPI, applications, advantages and limitations.

Module II: (10 hours)

Magnetic Particle Inspection (MPI)- Principles of MPI, basic physics of magnetism, permeability, flux density, cohesive force, magnetizing force, retentivity, residual magnetism

Methods of magnetization, magnetization techniques such as head shot technique, cold shot technique, central conductor testing- magnetization using products using yokes
Direct and indirect method of magnetization, continuous testing of MPI, residual technique of MPI, system sensitivity, checking devices in MPI- Interpretation of MPI, indications, advantage and limitation of MPI.

Module III: (10 hours)

Ultrasonic Testing (UT): principle, types of waves, frequency, velocity, wavelength, reflection, divergence, attenuation, mode conversion in ultrasonic UT testing methods.
Contact testing and immersion testing, normal beam and straight beam testing, angle beam testing, dual crystal probe, ultrasonic testing techniques, resonance testing, through transmission technique, pulse echo testing technique, instruments used UT, accessories such as transducers, types, frequencies, and sizes commonly used.
Reference blocks with artificially created defects, calibration of equipment, Applications, advantages, limitations, A, B and C scan - Time of Flight Diffraction (TOFD)

Module IV: (10 hours)

Radiography Testing (RT): Principle, electromagnetic radiation sources: X-ray source, production of X-rays, high energy X-ray source, gamma ray source - Properties of X-rays and gamma rays

Inspection techniques like SWSI, DWSI, DWDI, panoramic exposure, real time radiography, films used in industrial radiography, types of film, speed of films, qualities of film, screens used in radiography, quality of a good radiograph, film processing, interpretation, evaluation of test results, safety aspects required in radiography

Applications, advantages and limitations of RT

Module V: (10 hours)

Eddy Current Testing (ECT) - Principle, physics aspects of ECT like conductivity, permeability, resistivity, inductance, inductive reactance, impedance, Field factor and lift of effect, edge effect, end effect, impedance plane diagram in brief, depth of penetration of ECT, relation between frequency and depth of penetration in ECT, equipment's and accessories, various application of ECT such as conductivity measurement, hardness measurement, defect detection, coating thickness measurement, advantages and limitations of eddy current testing.

COURSE OUTCOMES:

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

- Classify various nondestructive testing.
- Explain non-destructive tests like: Liquid penetrant test, Magnetic particle test, Ultrasonic test, X-ray and Gamma ray radiography, Leak Test, Eddy current test.
- Identify the types of equipment used for each Non-Destructive and Destructive Examination.
- Explain the schemes to check different metals and alloys by different methods.
- Identify defects by using relevant NDT methods.

TEXT BOOKS:

1. Baldev Raj, Practical Non – Destructive Testing, Narosa Publishing House, Third Edition, 2019.

***REFERENCE BOOKS*:**

1. Hull B. and V.John, Non-Destructive Testing, Macmillan, 1988.
2. Krautkramer, Josef, Hebert Krautkramer, Ultrasonic Testing of Materials, Springer Verlag

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 803(B)	SUPPLY CHAIN MANAGEMENT	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To develop knowledge on structures, decision phases, measures and tools of supply chains.
- To develop understanding on the strategic, tactical and operational decision tools of supply chains.
- To understand how the environment affects the design, implementation and management of supply

SYLLABUS:

Module I: (10 hours)

Concept of Supply Chain, Value Chain for supply chain management, Integrated Supply chain, Drivers for supply chain management, Growth of supply chain, Major trends in supply chain management, Strategic decisions in supply chain, Supply Chain flows - Supply Chain and competitive performance – performance measures of Supply Chain –Strategic fit – Drivers and Obstacles

Module II: (10 hours)

Managing supply, managing demand and Managing variability – Inventory Management in Supply Chain – Uncertainties of demand, Inventory related costs, Types of inventory, Demand, Tools and techniques in inventory management, Managing supply chain inventory: Pitfalls and opportunities.

Module III: (10 hours)

Sourcing decisions in Supply Chain – management, Buyer's perspective to supply chain management, Supplier's perspective to supply chain management, Buyer supplier relations, Supplier relations in managing faster supply chain, Pricing and revenue management in Supply Chain – Coordination in Supply Chain – IT and Supply Chain

Module IV: (11 hours)

Managing Cross-Functional Drivers in A Supply Chain: Sourcing decisions in supply chain, Supplier selection and contracts, design collaboration, making sourcing decisions in practice. Pricing and revenue management in a supply chain, coordination in a supply chain Designing and Planning Transportation Networks: Role of transportation in supply chain, factors affecting transportation decisions. Transportation strategy in a Supply Chain, Routing and scheduling in transportation

Module V: (11 hours)

Aggregate Planning: Aggregate Planning Strategies, Aggregate Planning models - Quantitative Examples. Network Design, Locations and Layouts: Network design in Uncertain Environment, Facility Location and Layout decisions. Multi-echelon Inventory Systems: Inventory Planning Decisions –Estimate of Cycle Inventory, Discounting Models, Multi-item Inventory models, Determination of Safety Inventory, Impact of Supply Uncertainty, Multi- echelon Inventory models, Quantitative Examples. Bullwhip effect.

COURSE OUTCOMES:

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

- Describe the structures, decision phases, measures and tools of supply chains.
- Describe the strategic, tactical and operational decision tools of supply chains
- Identify the major issues in supply chain domain
- Frame supply chain systems and can able to forecast, estimate and calculate various parameters related to supply chain
- Get idea about inventory control, various logistics system, transportation networks etc.

TEXT BOOKS:

1. G. Sreenivasan, Quantitative Models in Operations and Supply Chain Management, PHI, 2010.
2. Sunil Chopra, Peter Meindl, Supply Chain Management – Strategy, Planning and Operation, Pearson Education, 7th Ed, 2019.
3. Dr. R P Mohanty, Dr. S G Deshmukh Essentials of Supply Chain Management, Jaico Publishing, 2004.

***REFERENCE BOOKS*:**

1. Janat Shah, Supply Chain Management: Text and Cases, Pearson Education South Asia, 2009.
2. Ronald H Ballou and Samir K Srivastava, Business Logistics/ Supply Chain Management, Pearson Education South Asia, 2007.
3. Harald Dyckhoff et al, Supply Chain Management and Reverse Logistic, Springer, 2004.
4. Christopher M, Logistics and Supply Chain Management, Pitman Publishing Company, 1992.
5. John Mortimer (Editor), Logistics in Manufacturing: An IFS Executive Briefing, IFS Publications, U.K. & Springer-Verlag.
6. Raghuram G. & Rangaraj N., Logistics and Supply Chain Management: Cases and Concepts, Macmillan India Limited, Laxmi Publications, 2015.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 803(C)	INDUSTRIAL SAFETY ENGINEERING	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To understand the concept of safety in industry.
- To understand the responsibilities of safety agency.
- To provide exposure on different safety assessment techniques.
- To learn about the industrial hazards and their control.
- To introduce the government regulations on industrial safety.

SYLLABUS:

Module I: Introduction to Industrial Safety (10 hours)

Introduction to the concept of safety-Need for safety- Goal of safety engineering Accidents and Injury- Definition- Unsafe act – Unsafe conditions-Accident investigation and prevention Responsibility of safety- Society, Govt, Management and employees- Duties of safety officer-Safety committee-Membership and Function- Emergency Planning and Preparedness (EEP)

Module II: Safety and Health Management (10 hours)

Industrial Hazards- Type of Industrial Hazards - Nature and Cause- Occupational Health Hazards- Ergonomics - Introduction, Definition, Objectives, Advantages. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders- Importance of Industrial safety, role of safety department, Safety committee and Function

Safety Awareness & Training: Training for Safety: Assessment of needs- Training methods and strategies. Training of manager, supervisors & workers. Evaluation of training programmes. Human behavior and safety: Human factors contributing to accidents- Work Permit System (WPS)

Module III: Safety Assessment and Control (12 hours)

Safety Management: Role of management in Industrial Safety, Principles & Practices - Safety Organization: Role of safety committee and its formation- Safety awareness programme: motivation, education and training, Appraisal of plant safety and measurement of safety performance- Safety Audit- Total loss control concept- Introduction to productivity, Quality, Reliability, and Safety (PQRS) theory.

Concept of workplace: Improving safety and productivity through work place design control measures. Technical and engineering control measures. Control measures against human error. Preventive maintenance. Role of Preventive maintenance in safety and health. Standards and code of practices for plant and equipment.

Module IV: Industrial Safety and Control (12 hours)

Concept of Industrial hygiene, programmes-Recognition –Evaluation- Control of Physical Hazards- Control of Chemical Hazards Hazardous: Classification of dangerous materials with pictorial symbols, common hazard and common precautions for each class- Control of Electrical Hazards: Dangers from electricity. Safe limits of amperages, Voltages Safe distance from lines, protection of conductors, Joints and connections, Means of cutting of power overload and short circuit protection.

Fire – Chemistry of fire. Classification of fires- Common causes of industrial fires- control and industrial fire protection systems, Fire Hydrant and extinguishers-

Module V: Safety Legalisation (8 hours)

Laws regarding Industrial safety: Safety provisions under Factories Act-1948, Factories Act (Amendment) 1987, Maharashtra Factories Rule- 1963,The Mines Act-1952, The Workmen CompensationAct-1923, ESI Act, Public Liabilities Insurance Act-1991.

COURSE OUTCOMES:

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

- Gain the general concept of industrial safety
- Know the occupational hazards contributing to industrial accidents
- Learn the concepts of safety management and safety auditing
- Identify and prevent hazard through analysis and apply proper safety techniques
- Know the general laws for industrial safety

TEXT BOOKS:

1. Frank P. Lees, Loss of prevention in Process Industries, Vol. 1 and 2, Butterworth-Heinemann Ltd., London, 1991.
2. Thomas J. Anton, Occupational Safety and Health Management, McGraw Hill, 1990.
3. Grimaldi, Simonds , Safety Management, AITBS Publishers, New Delhi, 2001.
4. R.K.Jain and Sunil S.Rao, Industrial Safety, Health and Environment Management Systems, Khanna Publishers, New Delhi, 2006.

***REFERENCE BOOKS*:**

1. Slote.L, Handbook of Occupational Safety and Health, John Willey & Sons, New York
2. The Factories Act with amendments 1987, Govt. of India Publications DGFASLI, Mumbai
3. BHEL, Occupational Safety Manual, Tiruchirappalli.
4. Industrial Safety -National Safety Council of India.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 803(D)	HYBRID AND ELECTRIC VEHICLES	3-1-0-3

PRE-REQUISITE: Advanced Automobile Engineering

COURSE OBJECTIVES:

- Understand the powertrain configurations of Electric, Hybrid Electric, Plug-in Electric and Plug-in Hybrid Electric Vehicles.
- Identify the main parts/ components and their role in the powertrains of various vehicle configurations.
- Learn about performance characteristics of Internal Combustion Engines.
- Learn proper energy storage systems for vehicle applications
- Identify various communication protocols and technologies used in vehicle networks

SYLLABUS:

Module I: (10 hours)
Introduction to electric vehicles– Battery Electric Vehicle (BEV)– Fuel Cell Electric Vehicle (FCEV)- social and environmental importance of hybrid and electric vehicles- Electric Vehicle Components
HEV Configurations: Series Hybrid Electric Drive Trains – Parallel Hybrid Electric Drive Trains – Series-Parallel Hybrid Electric Drive Trains

Module II: (10 hours)
Energy Storage: Introduction to Energy Storage- Requirements in Hybrid and Electric Vehicles- Types of batteries- Types of Fuel Cells used in FCEV - Hybridization of different energy storage devices
Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles- Configuration and control of DC Motor drives- Configuration and control of Induction Motor drives

Module III: (11 hours)
Role of Internal Combustion Engines in various Hybrid Electric Configurations
Performance of IC engines: Indicated Work per Cycles and Mean Effective Pressure – Mechanical Efficiency – Specific Fuel Consumption and Efficiency – Specific Emissions – Fuel/Air and Air/Fuel Ratio-Volumetric Efficiency
Performance of Electric Vehicles: Traction Motor Characteristics - Tractive effort - Vehicle Performance - Energy Consumption – Regenerative Braking

Module IV: (11 hours)
Hybrid Electric Drive-trains: Basic concept of hybrid traction- introduction to various hybrid drive-train topologies- power flow control in hybrid drive-train topologies -fuel efficiency analysis.
Electric Drive-trains: Basic concept of electric traction- introduction to various electric drive-train topologies- power flow control in electric drive-train topologies -fuel efficiency analysis.

Module V: (10 hours)

Communications- supporting subsystems: In vehicle networks- CAN- Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles- classification of different energy management strategies- comparison of different energy management strategies

COURSE OUTCOMES:

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

- Differentiate between the significance of various configurations of Electric vehicles (EVs) and Hybrid Electric vehicles (HEVs).
- Understand various energy storage systems and electric components used in hybrid and electric vehicles.
- Highlight the relationships between Operation and Performance Parameters in Electric Vehicles and IC engines.
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
- Identify various communication protocols and technologies used in vehicle networks.

TEXT BOOKS:

1. Iqbal Husain, Electric and Hybrid Vehicles Design Fundamentals, Second Edition, CRC Press, 2011.
2. Mehrdad Ehsani, Yimin Gao, and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles - Fundamentals, Theory, and Design, Second Edition, CRC Press, 2017.
3. Chris Mi and M. Abul Masrur, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, 2nd Edition, Wiley, 2017.

***REFERENCE BOOKS*:**

1. James Larminie and John Lowry, Electric Vehicle Technology Explained (WSE) Second Edition, Wiley, January 1, 2015.
2. Tom Denton, Introduction to Hybrid Vehicle System Modeling and Control, First Edition, Routledge, 2016.
3. Wei Liu, Introduction to Hybrid Vehicle System Modeling and Control, Wiley Student Edition, 2015.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 803(E)	CRYOGENIC ENGINEERING	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide the knowledge of evolution of low temperature science
- To provide knowledge on the properties of materials at low temperature
- To familiarize with various gas liquefaction systems and to provide design aspects of cryogenic storage and transfer lines
- To provide knowledge on basics of low temperature production and applications
- To give fundamental knowledge of types of cryogenic fluids

SYLLABUS:

Module I: (11 hours)

Introduction to Cryogenic Systems, Historical development, Low Temperature properties of Engineering Materials, Mechanical properties- Thermal properties- Electric and magnetic properties –Cryogenic fluids and their properties. Applications of Cryogenics: Applications in space, Food Processing, super Conductivity, Electrical Power, Biology, Medicine, Electronics and Cutting Tool Industry.

Module II: (10 hours)

Liquefaction systems: ideal system, Joule Thomson expansion, Adiabatic expansion, Linde Hampson Cycle, Claude & Cascaded System, Magnetic Cooling, Stirling Cycle Cryo Coolers.

Module III: (10 hours)

Gas liquefaction systems: Introduction - Production of low temperatures- General Liquefaction Systems-Liquefaction systems for Neon. Hydrogen and Helium – Critical components of Liquefaction systems.

Module IV: (10 hours)

Cryogenic Refrigeration systems: Ideal Refrigeration systems- Refrigeration using liquids and gases as refrigerant- Refrigerators using solids as working media, cryogenic fluid storage and transfer systems.

Module V: (11 hours)

Cryogenic Storage vessels and Transportation, Thermal insulation and their performance at cryogenic temperatures, Super Insulations, Vacuum insulation, Powder insulation, Cryogenic fluid transfer systems, Pressure flow-level and temperature measurements – Types of heat exchangers used in cryogenic systems. Cryopumping Applications.

COURSE OUTCOMES:

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

- Understand properties of material at cryogenic temperatures.
- Know about various liquefaction systems
- Get ideas on cryogenic refrigeration systems, cryogenic instrumentation and

cryogenic heat exchangers

- Discuss the application of Cryogenic technology in engineering research and Industry.
- Familiar with the principles and common practices of cryogenics

TEXT BOOKS:

1. J. H. Boll Jr, Cryogenic Engineering
2. R. B. Scott, Cryogenic Engineering, Van Nostrand Co., 1959.
3. Randal F.Barron, Cryogenic systems, McGraw Hill, 1986.

***REFERENCE BOOKS*:**

1. Klaus D.Timmerhaus and Thomas M.Flynn, Cryogenic Process Engineering, Plenum Press, New York, 1989.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 803(F)	LEAN SYSTEMS	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To identify manufacturing system waste.
- To understand the roles of employees and managers, supply chain issues, pre-automation and automation as they apply to lean manufacturing
- To compare and contrast the culture, organizational structure and leadership in mass production and Lean manufacturing environments.

SYLLABUS:

Module I: (10 hours)

Introduction, Definitions of Lean manufacturing, explaining basic concepts. Overview of historical development, sources of waste, Waste Elimination, Cause and Effect diagram, JIT Principles. 5S housekeeping Concepts, 5S auditing, Kaizen activities, Kaizen workshop, Benefits of kaizen, Kanban.

Module II: (10 hours)

Elements of Lean Production: Small-Lot Production, Lot-Size Basics, Lot Sizing, Lot-Size Reduction, Facilitating small Lot Sizes

Setup-Time reduction: Setup reduction methodology; techniques for setup-reduction; setup reduction projects.

Module III: (11 hours)

Maintaining and Improving Equipment: Equipment Maintenance, Equipment Effectiveness, Preventive Maintenance Program, Total Productive Maintenance, Implementing TPM.

Pull Production Systems: Production Control Systems, Process Improvement, How to Achieve Pull Production, Other Mechanisms for Signal and Control, To Pull or Not to Pull.

Module IV: (11 hours)

Focused Factories and Group Technology: Ways of Doing Work, Facilities Layout, Group Technology, Focused Factory, Establishing Product, Chapter Supplement.

Work cells and Cellular Manufacturing: Work cell Concepts, Work cell Applications, Work Design, Workers in Cells, Equipment Issues, Implementing, Getting Started.

Module V: (10 hours)

Lean Systems: Introduction to value stream mapping, VSM Principles, VSM Tools, Current Value stream mapping, Building a Current State Map, Application to the factory Simulation scenario. Future State Mapping.

COURSE OUTCOMES:

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

- Explain the concepts, theories of Lean Manufacturing, including key aspects of Just in Time, 5S, Kaizen and Kanban.
- Describe the importance of lot size in lean production and setup time.
- Analyse different industrial maintenance systems and the importance of pull production system in the lean manufacturing paradigm.
- Identify the principles of Group Technology and Cellular manufacturing.
- Analyse and apply value stream mapping concepts.

TEXT BOOKS:

1. John M Nicholas, Competitive Manufacturing Management, TMH, Edition, 2001.
2. Ronald G Askin, Jeffrey B Goldberg, Design and Analysis of Lean Production Systems, John Wiley, 2001.
3. V.K Jain, Micro manufacturing processes, CRC Press, 1st edition, 2012.

***REFERENCE BOOKS*:**

1. Pascal Dennis, Lean Production Simplified: A Plain-Language Guide to the World's Most Powerful Production System, 2nd Ed, 2007.
2. John Miltenburg, Manufacturing Strategy, Second Edition, 2005.
3. Don Tapping, Tom Luyster and Tom Shuker -Value Stream Management, Productivity Press, 2002.
4. Hong Hocheng and Hung-Yin Tsai, "Advanced analysis of non-traditional machining", Springer.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 804(A)	RENEWABLE ENERGY TECHNOLOGY	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To understand the environmental effects of energy conversion.
- To give an idea about global energy scenario and conventional energy sources
- To understand solar, wind and Biomass energy
- To know concepts of other renewable energy sources
- To create awareness on the impacts of energy conversion and importance of sustainable energy

SYLLABUS:

Module I: (10 hours)

Introduction- Global and Indian energy resources. Energy alternatives for future, India's present condition concerning non-conventional energy sources. Non-conventional energy for rural India. Non-conventional energy and cost. Energy Demand and supply. Components, layout and working principles of steam, hydro, nuclear, gas turbine and diesel power plants.

Module II: (11 hours)

Solar Energy- passive and active solar thermal energy, solar collectors, solar thermal electric systems, solar photovoltaic systems. Determination of total radiation on an inclined surface, Measurement of solar radiation. Wind Energy-Principle of wind energy conversion system, wind turbines, aerodynamics of wind turbines. Operating characteristics of wind-mill, Environmental impact of wind energy.

Module III: (11 hours)

Biomass Energy – Biomass as a fuel, thermo-chemical, bio-chemical and agro-chemical conversion of biomass- pyrolysis, gasification, combustion and fermentation, transesterification. Liquid fuel from biomass, power generation systems using biofuels, Biomass cogeneration system, Biomass energy programme in India.
Energy technologies: Fluidized bed combustion – fluidized bed boilers – waste heat recovery systems

Module IV: (10 hours)

Other Renewable Energy sources – Brief account of Geothermal, OTEC, Tidal, Wave, MHD power generation, small, mini and micro hydro power plants. Fuel cells – general description, types, applications. Hydrogen energy conversion systems, hybrid systems- Economics and technical feasibility.

Module V: (10 hours)

Environmental impact of energy conversion – ozone layer depletion, global warming, greenhouse effect, loss of biodiversity, eutrophication, acid rain, air and water pollution, land degradation, thermal pollution.
Economics of non-convention al energy systems – Life cycle costing, Present worth factor, Present worth of capital and maintenance cost.

COURSE OUTCOMES:

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

- Get an awareness about renewable energy technology.
- Become aware of solar and wind energy sources
- Become aware about bio energy conservation methods.
- Understand about other renewable energy sources.
- Get an awareness about the environment impact of energy conversion process.

TEXT BOOKS:

1. Tiwari G N, Ghosal M K, Fundamentals of renewable energy sources, Alpha Science International Ltd., 2007

***REFERENCE BOOKS*:**

1. O. Callaghn, Design and Management for energy conservation, Pergamon Press, Oxford, 1981.
2. D. Merick, Energy - Present and Future Options, vol 1 and 2, John Wiley and Sons
3. N. A. Chaigier, Energy Consumption and Environment, McGraw Hill
4. W. R. Murphy, G. Mc Kay, Energy Management, Butterworths, London, 1981.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 804(B)	AEROSPACE ENGINEERING	3-1-0-3

PRE-REQUISITE: Gas Dynamics and Jet Propulsion

COURSE OBJECTIVES:

- To impart the concepts of aerospace engineering.
- To develop understanding about aerofoil theory and airplane performance.
- To provide an understanding of flight instruments
- To make the students aware about challenges and opportunities in the field of aerospace engineering.
- To understand the principles of wind tunnel testing

SYLLABUS:

Module I: (10 hours)

The atmosphere-characteristics of troposphere, stratosphere, thermosphere, and ionosphere-pressure, temperature and density variations in the atmosphere. Application of dimensional analysis – aerodynamic force – model study and similitude. 2D aero foils -Nomenclature and classification- pressure distribution in inviscid and real flows- momentum and circulation theory of aerofoil- characteristics.

Module II: (10 hours)

3D or Finite aero foils – effect of releasing the wingtips- wing tip vortices- replacement of finite wing by horse shoe vertex system, lifting line theory-wing load distribution – aspect ratio, induced drag calculation of induced drag from momentum considerations. Skin friction and from drag- changes in finite wing plan shape

Module III: (12 hours)

Propellers – momentum and blade element theories –propeller coefficients and charts. Aircraft performance-straight and level flight –power required and power available graphs for propeller and jet aircraft

Gliding and climbing –rate of climb-service and absolute ceilings-gliding angle and speed of flattest glide take-off and landing performance – length of runway required- aircraft ground run- circling flight – radius of tightest turn-jet and rocket assisted take –off high lift devices-range and endurance of airplanes-charts for piston and jet engine aircrafts..

Module IV: (10 hours)

Flight Instruments-airspeed indicator, calculation of true air speed-altimeter, gyrohorizon -direction indicator-vertical speed indicator –turn and back indicator-air temperature indicator. (Brief description and qualitative ideas only). Ideas on stability-static and dynamic stability-longitudinal, lateral and directional stability- controls of an aero plane- aerodynamic balancing of control surfaces- mass balancing (Qualitative ideas only)

Module V: (10 hours)

Principles of wind tunnel testing –open and closed type wind tunnels-wind tunnel balances supersonic wind tunnels. Study of subsonic, Transonic, and supersonic aircraft engines (Description with figures only). Elementary ideas on space travel-calculation of earth orbiting and escape velocities ignoring air resistance and assuming circular orbit.

COURSE OUTCOMES:

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

- Identify, formulate and solve aerospace engineering problems.
- Perform analysis of flight dynamics of aircrafts.
- Explain the principles of wind tunnel testing.
- Familiar with aircraft instruments & Controls.
- Explain Gliding and climbing.

TEXT BOOKS:

1. A.C. Kermode, Mechanics of flight, Prentice Hall, 2007.
2. Anderson, Fundamentals of Aerodynamics, McGraw-Hill, 2010.
3. E H J Pallett, Aircraft Instruments and Integrated systems, Longman, 1992.

***REFERENCE BOOKS*:**

1. Houghton and brock, Aerodynamics for Engineering Student, Hodder & Stoughton, 1977.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 804(C)	ADDITIVE MANUFACTURING	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide basic knowledge in additive manufacturing technology.
- To familiarize basic Additive Manufacturing methods

SYLLABUS:

Module I: (12 hours)

Introduction to reverse engineering, Traditional manufacturing v/s Additive Manufacturing, Definition of Rapid Product Development, Virtual prototypical and rapid manufacturing technologies, Physical Prototyping & rapid manufacturing technologies, Materials used in AM, Use of multiple materials, multifunctional and graded materials

Module II: (10 hours)

Rapid prototyping: Introduction to Rapid Prototyping, RP technologies, Selection of a suitable RP process for a given application, Status of outstanding issue in RP- accuracy, speed, materials (strength, homogeneity and isotropy), Emerging Trends,

Rapid Tooling: Introduction to Rapid Tooling, Indirect Rapid Tooling, Silicon rubber tooling, Aluminium filled epoxy tooling, Spray metal tooling, Direct Rapid Tooling

Module III: (10 hours)

Liquid based system, Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system – Fused Deposition Modeling, principle, process, products, advantages, applications and uses – Laminated Object Manufacturing, Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses.

Module IV: (10 hours)

Three-Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing – Laser Engineered Net Shaping (LENS)

Module V: (10 hours)

Data Extraction, Data Processing, Applications and Case Studies: Engineering Applications, Medical Applications, Processing of Polyhedral Data: Polyhedral B-rep modeling, Introduction to STL format, Defects and repair of STL files, Overview of the algorithms required for RP&T and Reverse Engineering, Laboratory and demonstration sessions

COURSE OUTCOMES:

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

- Discuss about the various dimensions of Additive manufacturing [AM] and to classify the various AM techniques.
- Acquire Fundamental knowledge about various materials used for Additive manufacturing
- Discuss about the parameters influencing the solid, liquid and powder based AM processes.
- Explain the different Rapid Tooling techniques.
- To get fundamental knowledge of data processing and data extraction methods

TEXT BOOKS:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive manufacturing technologies: rapid prototyping to direct digital manufacturing, Springer, 2010.

***REFERENCE BOOKS*:**

1. Andreas Gebhardt, Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing, Hanser Publishers, 2011.
2. J.D. Majumdar and I. Manna, Laser-assisted fabrication of materials, Springer Series in Material Science, e-ISBN: 978-3-642- 28359-8, 2013.
3. L. Lu, J. Fuh and Y.-S. Wong, Laser-induced materials and processes for rapid prototyping, Kluwer Academic Press, 2001.
4. C.K. Chua, K.F. Leong and C.S. Lim, Rapid prototyping: principles and applications, 3rd Edition, World Scientific, 2010.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 804(D)	MACHINE LEARNING AND APPLICATIONS	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To understand state of the art Machine Learning algorithms.
- To provide knowledge on various regression methods.
- To familiarize with logistic regression
- To know about neural networks
- To be familiar with recommender systems

SYLLABUS:

Module I: (12 hours)

Idea of Machines learning from data, Classification of problem – Regression and Classification, Supervised and Unsupervised learning.

Linear Regression: Model representation for single variable, single variable Cost Function, Gradient Decent for Linear Regression, Multivariable model representation, Multivariable cost function, Gradient Decent in practice, Normal Equation and non-invertibility

Module II: (10 hours)

Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting, Regularization

Module III: (11 hours)

Neural Networks: Non-linear Hypothesis, Biological Neurons, Model representation, Intuition for Neural Networks, Multiclass classification, Cost Function, Back Propagation Algorithm, Back Propagation Intuition, Weights initialization, Neural Network Training

Module IV: (10 hours)

Support Vector Machines: Optimization Objective, Large Margin Classifiers, Kernels, SVM practical considerations.

Unsupervised learning: Unsupervised learning introduction, k-Means Algorithm, Optimization objective, Random Initialization, Choosing number of clusters

Module V: (9 hours)

Recommender Systems: Problem Formulation, Content based recommendations, Collaborative Filtering, Vectorization, Implementation details.

COURSE OUTCOMES:

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

- Gain knowledge about basic concepts of Machine Learning
- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Apply Dimensionality reduction techniques.
- Design application using machine learning techniques.

TEXT BOOKS:

1. Machine Learning, Tom M. Mitchell, McGraw Hill, 1997.

***REFERENCE BOOKS*:**

1. Building Machine Learning Systems with Python, Richert & Coelh, Packt publishers, 2013.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 804(E)	ROBOTICS AND AUTOMATION	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide the concepts of vision system and image processing
- To impart knowledge about Robot drive systems
- To familiarize different sensors.
- To equip students to write programs for automatic functioning of a robot
- To familiarize various robot sensors and their perception principles that enable a robot

SYLLABUS:

Module I: (10 hours)

Definition – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Basic robot motions - Point to point control, Continuous path control. Robot Parts and Their Functions – Need for Robots Different Applications.

Module II: (13 hours)

Robot drive systems: Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives.

End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

Module III: (9 hours)

Sensors and machine vision: Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Laser Range Meters).

Module IV: (11 hours)

Proximity Sensors (Inductive, Capacitive, and Ultrasonic), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Robot kinematics and robot programming: Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional) – Deviations and Problems.

Module V: (9 hours)

Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs. Industrial Applications: Application of robots in machining, welding, assembly, and material handling.

COURSE OUTCOMES:

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

- Recall the evolution of robotics and to explain the terminologies used.
- Classify and characterize the robots based on the configuration and work volume
- Compare the different sensors and actuators (drive systems) used in robotics.
- Differentiate between the Forward Kinematics, Inverse Kinematics and to apply in solving problems.
- Analyse the programming principles and to develop programs using the commands

TEXT BOOKS:

1. Janakiraman P A, Robotics and Image Processing, Tata McGraw-Hill, 1995.
2. Yu Kozyrev, Industrial Robots, Mir Publishers, 1985.
3. M.P.Groover, Industrial Robotics: Technology, Programming and Applications, McGraw-Hill, 2001

***REFERENCE BOOKS*:**

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw-Hill Book Co., 1987.
2. Yoram Koren, Robotics for Engineers, McGraw-Hill Book Co., 1992.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 804(F)	RELIABILITY AND INDUSTRIAL MAINTENANCE	3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To empower with the skills to manage a manufacturing system to achieve continuous system availability for production.
- To achieve a reliable manufacturing system.
- To develop ability in formulating suitable maintenance strategies
- To provide knowledge on basic concepts of maintenance, vibration monitoring, non-destructive testing

SYLLABUS:

Module I: (12 hours)

Definition of reliability - definition of failure - classification of failures - measures of reliability - failure rate, Mean Time between Failures (MTBF), Mean Time to Failure (MTTF) - derivation of the reliability function - reliability specifications, Product life cycle and cost, Reliability training programs, product safety and liability-Roles and Responsibilities, Ethical Issues, System Safety Program.

Module II: (12 hours)

The bath tub curve - early failure period, constant failure period, the wear out failure period – the Weibull distribution - the Weibull distribution to describe the bath tub curve - estimation of Weibull parameters, Weibull probability plot. Failure analysis techniques, Case histories of failures.

Module III: (10 hours)

Basic concept's purpose and functions of maintenance, Planned and unplanned Maintenance, Breakdown Maintenance, corrective Maintenance, Opportunistic Maintenance, Routine Maintenance, Preventive Maintenance, Predictive Maintenance, Condition Base Maintenance System (CBMS): Online offline Monitoring, Visual and Temperature Monitoring, Leakage Monitoring, Vibration Monitoring: causes, identification, and monitoring.

Module IV: (10 hours)

Elementary problem diagrams – misalignment – unbalance – vibration monitoring and analysis – Vibration analysis – proximity analysis – frequency analysis – spectral analysis – real time analysis vibration limits vibration severity criteria vibration severity charts – shock pulse analysis application to condition monitoring of ball and roller bearings - vibration signature analysis.

Module V: (8 hours)

Ferrography – spectral oil analysis procedure – non-destructive testing – liquid penetrant testing – radio graphic inspection – ultra sonic testing acoustic emission corrosion monitoring – resistance techniques – technique providing information on plant regarding corrosion monitoring

COURSE OUTCOMES:

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

- Describe the relationship of key concepts in reliability engineering and application to maintenance strategies in a manufacturing environment
- Get an idea about different types of maintenance operations and able recognize troubles in mechanical elements
- Carry out plant maintenance using tri-bology and preventive maintenance.
- Explain the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- Demonstrate Defects and Failure analysis and different types of maintenance system

TEXT BOOKS:

1. L. S. Sreenath, Vibration spectrum analysis A practical approach, Steve Goldman Industrial Press Inc., 1985.
2. Charles E Eblings–"An Introduction to Reliability and Maintainability Engineering", McGraw Hill, 2017.

***REFERENCE BOOKS*:**

1. E. Balagrusamy, Reliability Engineering, Tata McGraw Hill Publishing Company Limited, New Delhi
2. L S Srinath, Reliability Engineering, East West Press (P) Ltd., 1985.
3. Lewis, E. E., Introduction to Reliability Engineering, John Wiley & Sons, New York, 1995.
4. Patric O'Connor, Practical Reliability Engineering, 3/e revised, John Wiley & Sons 1996.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - 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.

ME19 805 (P)	SEMINAR	0-0-6-2

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To assess the ability of the student to study and present a seminar on a topic of current relevance in the field of Mechanical Engineering or allied areas.
- To develop skills in doing literature survey, technical presentation and report preparation.

SYLLABUS:

Seminar is intended to encourage and motivate the students to explore the latest trends in technology related to their area of interest confined to the relevant discipline. They need to identify a topic from latest technical publications including peer reviewed journals, conference proceedings, technical reports, books etc. The student need to prepare a report based on a topic and present it before a team of faculty and students. A faculty member can guide maximum of five students of his 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. A committee consisting of three faculty members can evaluate the seminar presentation and report. The evaluation can be based on various factors like, depth of knowledge in the topic, presentation skills, confidence level of the candidate, ability in answering questions etc. Due consideration will be given to the technical content, adequacy of references, and overall presentation and quality of the candidate's seminar report during the evaluation process.

COURSE OUTCOMES:

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

- Analyse a current topic of professional interest and present it before an audience.
- Review literature on a given advance topic related to the specific stream.
- Prepare a summary of various concepts systematically after considerable study of the content from primary as well as secondary sources.
- Present and discuss the concept & conclusion in an open seminar.
- Present technical report as per specified norms.

Internal Continuous Assessment *(Maximum Marks-100, Minimum required to pass-50)*

10% - Attendance

20% - Seminar Guide

30% - Technical content of the report

40% - Presentation

ME19 806 (P)	PROJECT PHASE II	0-0-8-6

PRE-REQUISITE: Project Phase I

COURSE OBJECTIVES:

- To enable the students to apply the engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.
- To design and develop a software/hardware project to innovatively solve a real-world problem.

SYLLABUS:

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least two Interim Evaluation and a final evaluation of the project in the 8^{th} semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation.

Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the HOD or a senior faculty member, guide and three/four faculty members specialized in different streams in Mechanical Engineering i.e. Thermal Sciences/ Manufacturing/ Design/ Management etc.

COURSE OUTCOMES:

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

- Apply engineering knowledge in practical problem solving.
- Develop creative thinking in finding viable solutions to engineering problems.
- Design innovative products, processes or systems.
- Practice team dynamics to work effectively in a team for the development of technical projects.
- Develop skills in technical presentation and report preparation.

Assessment Pattern

The Continuous Internal Evaluation (CIE) will be conducted as 2 Interim evaluations and a final evaluation.

The Interim evaluation, 2 times in the semester will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a project evaluation committee appointed by Head of the Department. First evaluation is to assess the progress of the work, presentation and discussion. Second Evaluation would be a pre-submission presentation before the evaluation committee to assess the quality and quantum of the work done. It is advised to invite the project guide of the concerned batch for the final evaluation.

The final evaluation committee comprises Project coordinator, two faculty members/ expert from Industry/research Institute/ senior faculty from another department (for interdisciplinary projects-(if any)).

Internal Continuous Assessment *(Maximum Marks-100, Minimum required to pass-50)*

30% - Project Guide

20% - Interim evaluation by the evaluation committee

20% - Quality of the report evaluated by the above committee

30% - Final evaluation by a three- member faculty committee

ME19 807 (P)	VIVA VOCE	0-0-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To examine the knowledge acquired by the student during the B.Tech course, through an oral examination

SYLLABUS:

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. Course, seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level.

For final viva-voce, candidates should produce certified reports of Internship, Seminar and Project. If he/she has undergone industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce.

COURSE OUTCOMES:

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

- Demonstrate knowledge in the program domain.
- Present his views cogently and precisely
- Exhibit professional etiquette suitable for career progression

Assessment in Viva Voce *(Maximum Marks-100, Minimum required to pass-50)*

10% - Industrial training/industrial visit/educational tour or Paper presented at National-level

20% - Seminar

30% - Project

40% - Subjects

UNIVERSITY OF CALICUT

CURRICULUM

&

SYLLABUS

(1 TO 8 SEMESTERS)

B. Tech. – PRINTING TECHNOLOGY

(2019 SCHEME)

(Applicable to 2019 admission onwards)

B. TECH PRINTING TECHNOLOGY

CURRICULUM

1st to 8th SEMESTERS

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	3
2	Basic Science courses	24
3	Engineering Science Courses	19
4	Program Core Courses	74
5	Program Elective Courses	15
6	Open Elective Courses	3
7	Internship, Seminar, Project Work and Course-Viva	15
8	Mandatory Non-credit Courses	-----
9	Practical Sessions	16
10	Mandatory Student Activities	1
	Total Mandatory Credits	170
11	Value Added Course (Optional)	20

Semester-wise credit distribution shall be as below:

Sem	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Credits	19	19	19	20	22	22	24	24	169
Activity Points	50/ 25*				50				100/75*
Credits for Activity	1								1
Grand Total									**170**

***applicable to Lateral Entry (LE) students**

BASIC SCIENCE COURSES: Maths, Physics, Chemistry, Biology for Engineers, Life Science etc

ENGINEERING SCIENCE COURSES: Basic Electrical, Basic Electronics, Engineering Graphics, Programming, Basic Printing, Basic Civil, Engineering Mechanics, Workshops etc.

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES: Principles of Management & Economics etc.

MANDATORY NON-CREDIT COURSES: Environmental Science, Constitution of India, Life Skills & Ethics for Engineers, Communicative English, and Concept based Engineering. There will be only internal evaluation of non-credit courses, and no University examinations will be conducted. A minimum 50% internal mark is to be obtained for securing a pass in these subjects. A student has to pass the exam within 4 chances, failing which the student has to undergo course repeat for the subject.

VALUE ADDED COURSE: Students can attend various value added MOOC (Massive Open Online Courses) like NPTEL courses conducted by nationally or internationally reputed institutions with in like IIT,IIST etc, and abroad (from foreign universities) and earn a maximum of 20 additional credits for getting 'Honours' degree in the discipline with a condition that he/she should have secured an aggregate of 8.0 CGPA up till final semester without any history of backlogs. Thus, the candidate can earn a max of 190 credits during his/her period of studies up to 8th semester. The selected course can be on same discipline or in any other relevant discipline pertaining to engineering/management/social science. 4 credits will be awarded to a student on successful completion of each MOOC. Thus, a student will be eligible to get an undergraduate degree with 'Honours' when he/she successfully earns an additional requirement of 20 credits through the successful completion of 5 MOOCs.

Successful completion of a MOOC is considered only when a student scores a minimum score of 60 (or equivalent to 60%) and above in the respective course. The additional value-added MOOC courses can be of 8 – 12-week duration. Each student who wish to do a MOOC should take prior permission from the respective Head of the Department, registering for the same with the institution which is hosting the course. The Head of the Department should verify the details of the course and ensure that the course content is relevant to his/her discipline before giving the approval. The details of MOOC courses undertaken by a student (if any) and the credits earned must be consolidated by the Tutor, forwarded by HOD and approved by Principal. The same has to be entered in the University portal by the college officials before the commencement of every end semester university examination.

HONOURS: -

Calicut University is providing this option for academically extra brilliant students to acquire Honours. Honours is an additional credential; a student may earn if she/he opts for the extra 20 credits needed for this in her/his own discipline with a condition that he/she should not have failed in any of the subjects till final semester and have secured an aggregate of 8.0 CGPA up till final semester. Honours is not indicative of class. Honours is intended for a student to gain expertise/specialise in an area inside his/her major B-Tech discipline to enrich knowledge in emerging/advanced areas in the branch of engineering concerned and interdisciplinary areas including management. 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 20 credits from the honours and 160 credits from their respective B-tech syllabus, the student will earn a total credit of 190 at the end of the programme which he/she will be eligible to get the Degree Certificate as “Bachelor of Technology in Printing Technology, 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 marks up to seventh semester and the number of value-added courses and credits earned before the commencement of the 8th 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 PT19 807 (P)**.** The first two letter code refers to the department offering the course. PT stands for Printing Technology. The second two digits represent the year in which the syllabus is implemented, thus the digit 19 represents the year 2019. Out of the next three digits, the first digit represents the semester in which the subject belongs, Eg. In 807, 8 means 8th semester and 07 is the 7th subject in that semester. The last alphabet represents whether the subject belongs to the Practical or laboratory category. Eg. (P) Means the subject belongs to the Practical category.

L-T-P-STRUCTURE: -

Notations	Description
L	Lecture hours- For theory-based courses hours are represented in this form Eg 3-0-0, means 3-hour 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, 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 means one hour is dedicated for the above-mentioned purpose.

Description
Theory based courses (other the lecture hours, these courses can have tutorial and practical hours, e.g., L-T-P structures 3-0-0, 3-1-2, 3-0-2 etc.)
Laboratory based courses (where performance is evaluated primarily on the basis of practical or laboratory work with LTP structures like 0-0-3, 1-0-3, 0-1-3 etc.)

DEPARTMENTS: -

Each course is offered by a Department and their two-letter course prefix is given in Table

Departments and their codes

Sl.No	Department	Course Prefix
01	Electrical & Electronics Engineering	EE
02	Electronics & Communication Engineering	EC
03	Information Technology	IT
04	Mechanical Engineering	ME
05	Printing Technology	PT

INDUCTION PROGRAM

A mandatory induction program for first semester students is designed for three weeks. This unique three-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 freshers 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:

The programme is designed to attain the following objectives:

- **Values and Ethics**: Focus 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.

SUBJECTS AND GROUPS IN 1st and 2nd SEMESTER			
GROUP	**SUBJECT CODE**	**SUBJECT NAME**	**COMP/OPT**
A	MA19 100	Calculus and Linear Algebra	COMP FOR SEM1
	MA19 200	Differential Equations and Vector Calculus	COMP FOR SEM 2
B	CH19 100	Engineering Chemistry	OPT (1/2) IN BOTH SEMESTERS
	PH19 100	Engineering Physics	

C	GS19 100	Engineering. Graphics	OPT (1/2) IN BOTH SEMESTERS
	EM19 100	Engineering Mechanics	
D	EC19 100	Concepts of Electronics Engineering	COMP FOR EC IN SEM 1
	EE19 100	Concepts of Electrical Engineering	COMP FOR EE IN SEM 1
	ME19 100	Concepts of Mechanical Engineering	COMP FOR ME IN SEM 1
	IT19 100	Introduction to Computing and Problem Solving	COMP FOR IT IN SEM 1
	PT19 100	Concepts of Printing Technology	COMP FOR PT IN SEM 1
E*	EC19 101	Basics of Electronics Engineering	OPT (1/4) FOR SEM1 & OPT (2/4) FOR SEM 2-RELEVANT SUBJECTS
	EE19 101	Basics of Electrical Engineering	
	CE19 101	Basics of Civil Engineering	
	ME19 101	Basics of Mechanical Engineering	
F	ES19 100	Environmental Science	COMP FOR SEM 1
	DE19 200	Concept Based Engineering	COMP FOR SEM 2
G	CH19 100(P)	Engineering Chemistry Lab	OPT (1/2) IN BOTH SEMESTERS
	PH19 100(P)	Engineering Physics Lab	
H**	EE19 100(P)	Electrical Engineering Workshop	OPT (2/4) IN BOTH SEMESTERS
	EC19 100(P)	Electronics Engineering Workshop	
	CE19 100(P)	Civil Engineering Workshop	
	ME19 100(P)	Mechanical Engineering Workshop	
	IT19 100(P)	Introduction to Computing and Problem Solving Lab	
	PT19 100 (P)	Printing Technology Workshop	
I	CM19 100	Communicative English	COMP FOR SEM 1
	LL19 200	Language Lab	COMP FOR SEM2

COMP- COMPULSORY SUBJECT

OPT – OPTIONAL SUBJECT

* Concerned branches have to avoid choosing Basic of Engineering (E) ie., Mechanical Engineering students are not permitted to choose Basics of Mechanical Engineering and same is applicable for other branches also.

** EE19 100(P), EC19 100(P), ME19 100(P), IT19 100 (P), PT19 100 (P) are COMPULSORY for respective branches in SEMESTER 1.

SCHEME OF 1ST SEMESTER B.TECH PRINTING TECHNOLOGY COURSE

Subject code	Subject Name	HOURS			MARKS		Duration of End Semester Examination	Credits
		L	T	P	Internal	End Semester		
MA19 100	Calculus and Linear Algebra	3	1	0	50	100	3	4
PH19/ CH19 100	Engineering Physics/ Engineering Chemistry	3	1	0	50	100	3	4
GS19/ EM19 100	Engineering Graphics/	3	0	2	50	100	3	4
	Engineering Mechanics	3	2	0				
PT 19 100	Concepts of Printing Technology	2	1	0	50	100	3	2
ME19 101/ EC19 101/ EE19101	Basics of Mechanical Engineering/ Basics of Electronics Engineering/ Basics of Electrical Engineering	2	1	0	50	100	3	2
ES19 100	Environmental Science	2	0	1	100	-	-	0
CM19 100	Communicative English	2	0	0	100	-		0
PH19 /CH19 100 (P)	Engineering Physics/ Engineering ChemistryLab	0	0	2	100	-	3	1
EC19/ EE19 ME19 100 (P)	Electronics /Electrical / Mechanical Engineering Workshop	0	0	2	100	-	3	1
PT19 100 (P)	Printing Technology Workshop	0	0	2	100	-	3	1
	TOTAL	**30**			**750**	**500**		**19**

COMMUNICATIVE ENGLISH

Objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for their professional needs. Coverage: Listening, Barriers to listening, Steps to overcome them, Purposive listening practice, Use of technology in the professional world. Speaking, Fluency & accuracy in speech, Positive thinking, improving self-expression, Tonal variations, Group discussion practice, Reading, Speed reading practice, use of extensive readers, Analytical and critical reading practice, Writing Professional Correspondence, Formal and informal letters, Tone in formal writing, Introduction to reports. Study Skills, Use of dictionary, thesaurus etc., Importance of contents page, cover & back pages, Bibliography, Language Lab.

SCHEME OF 2nd SEMESTER B.TECH PRINTING TECHNOLOGY COURSE

Subject code	Subject Name	HOURS			MARKS		Duration of End Semester Examination	Credits
		L	T	P	Internal	End Semester		
MA19 200	Differential Equations And Vector Calculus	3	1	0	50	100	3	4
PH19 100	Engineering Physics/	3	1	0	50	100	3	4
CH19 100	Engineering Chemistry							
EM19/	Engineering Mechanics/	3	2	0	50	100	3	4
GS19100	Engineering Graphics	3	0	2				
EE19 101	Basics of Electrical Engineering	2	1	0	50	100	3	2
ME19 101/ EC19 101	Basics of Mechanical/ Electronics Engineering	2	1	0	50	100	3	2
DE19 200	Concept Based Engineering	2	0	1	100	-	-	0
LL19 200	Language Lab	0	0	2	100	-	-	0
PH19/	Engineering Physics/							

CH19 100(P)	Chemistry Lab	0	0	2	100		3	1
EE19100(P)	Electrical/	0	0	2	100		3	1
CE19100 (P)	Civil Engineering Workshop							
ME19/	Mechanical/							
EC19100 (P)	Electronics Engineering Workshop	0	0	2	100		3	1
	TOTAL	**30**			**750**	**500**		**19**

SCHEME OF 3rd SEMESTER B.TECH PRINTING TECHNOLOGY COURSE								
Subject code	**Subject Name**	**L**	**T**	**P**	**Internal**	**End Semester**	**Duration of End Semester Examination**	**Credits**
EN19 301	Engineering Mathematics-III (Differential Calculus)	3	1	0	50	100	3	4
PT19 302	Computer Programming in C	2	0	2	50	100	3	3
PT19 303	Paper and Ink	4	0	0	50	100	3	4
PT19 304	Graphic Arts Techniques	4	0	0	50	100	3	3
PT19 305	Graphic Design and Electronics Composition	4	0	0	50	100	3	3
EN19 306	Life Skills & Ethics for Engineers	2	0	2	100	-	-	0
PT19 307(P)	Printing Software Lab	0	0	3	50	100	3	1
PT19 308(P)	Pre-production Lab	0	0	3	50	100	3	1
	TOTAL	**19**	**1**	**10**	**450**	**700**		**19**
		30						

LIFE SKILLS & ETHICS FOR ENGINEERS

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers. Professional ethics is highly needed for an engineer. This course will focus on to improvise the ethical quality of an engineer to meet the changing demands and requirements of the society.

SCHEME OF 4th SEMESTER B.TECH PRINTING TECHNOLOGY COURSE

Subject code	Subject Name	L	T	P	Internal	End Semester	Duration of End Semester Examination	Credits
EN 19 401	Engineering Mathematics IV	3	1	0	50	100	3	4
PT19 402	Offset Technology	3	0	1	50	100	3	4
PT19 403	Strength of Material	3	1	0	50	100	3	3
PT19 404	Printing Material Science	4	0	0	50	100	3	4
PT19 405	Electrical Drives and Control	3	1	0	50	100	3	3
EN19 406	Constitution of India	2	0	2	100	-	-	0
PT19 407(P)	Print Production Lab	0	0	3	50	100	3	1
PT19 408(P)	Machine Drawing Lab	0	0	3	50	100	3	1
	TOTAL	**18**	**3**	**9**	**450**	**700**		**20**
		30						

SCHEME OF 5th SEMESTER B.TECH PRINTING TECHNOLOGY COURSE								
Subject code	**Subject Name**	**L**	**T**	**P**	**Internal**	**End Semester**	**Duration of End Semester Examination**	**Credits**
EN19 501	Engineering Economics and Principles of Management	3	1	0	50	100	3	3
PT19 502	Packaging Technology	4	0	0	50	100	3	4
PT19 503	Microprocessor and Microcontroller	3	1	0	50	100	3	3
PT19 504	Flexography	4	0	0	50	100	3	4
PT19 505	Machine Dynamics	3	1	0	50	100	3	3
PT19 506	Program Elective-I	3	1	0	50	100	3	3
PT19 507(P)	Packaging Technology Lab	0	0	3	50	100	3	1
PT19 508(P)	Electrical & Electronics Lab	0	0	3	50	100	3	1
	TOTAL	**20**	**4**	**6**	**400**	**800**		**22**
		30						

Program Elective I	
PT19 506 (A)	Industrial Psychology
PT19 506 (B)	Mechanics of Printing
PT19 506 (C)	Computer Graphics
PT19 506 (D)	Designing and Planning for Media Production
PT19 506 (E)	Entrepreneurship Management
PT19 506 (F)	Advance Graphics Technology

SCHEME OF 6th SEMESTER B.TECH PRINTING TECHNOLOGY COURSE

Subject code	Subject Name	L	T	P	Internal	End Semester	Duration of End Semester Examination	Credits
PT19 601	Screen Printing & Gravure	3	0	1	50	100	3	4
PT19 602	Post Production Technology	4	0	0	50	100	3	4
PT19 603	Digital Printing & Pre-Press	4	0	0	50	100	3	3
PT19 604	Tone & Colour Analysis	4	0	0	50	100	3	3
PT19 605	Program Elective-II	3	1	0	50	100	3	3
PT19 606	Open Elective- I	3	1	0	50	100	3	3
PT19 607 (P)	Post Production Lab	0	0	3	50	100	3	1
PT19 608(P)	Screen Printing & Flexography Lab	0	0	3	50	100	3	1
	TOTAL	**21**	**2**	**7**	**400**	**800**		**22**
		30						

Submission of report for in ernship done during the break of semester 6 can be done during thestart of semester 7.

Program Elective II		**Open Elective- I**	
PT19 605 (A)	Printronics	PT19 606 (A)	Product Design and Development
PT19 605 (B)	Multimedia	PT19 606 (B)	Research Methodology
PT19 605 (C)	Scanners & Systems	PT19 606 (C)	Industrial Pollution Control
PT19 605 (D)	Book Publishing	PT19 606 (D)	Marketing Management
PT19 605 (E)	Packaging Laws and Regulation	PT19 606 (E)	Quantitative Techniques for Engineers
PT19 605 (F)	Analysis of Printing Ink	PT19 606 (F)	Disaster management

OPEN ELECTIVE: These elective subjects are 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 focused 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.

SCHEME OF 7th SEMESTER B.TECH PRINTING TECHNOLOGY COURSE								
Subject code	**Subject Name**	**L**	**T**	**P**	**Internal**	**End Semester**	**Duration of End Semester Examination**	**Credits**
PT19 701	Advancement in Printing Technology	3	0	1	50	100	3	4
PT19 702	Quality Control and Standardization	4	0	0	50	100	3	3
PT19 703	Print Plant Layout & Facility Design	3	0	1	50	100	3	4
PT19 704	Printing Machinery and Maintenance	3	0	1	50	100	3	4
PT19 705	Program Elective-III	3	1	0	50	100	3	3
PT19 706(P)	Tone and Color Analysis Lab	0	0	3	50	100	3	1
PT19 707 (P)	Quality Control Lab	0	0	3	50	100	3	1
PT19 708(P)	Project Phase-I	0	0	4	100	-	3	3
PT19 709(P)	Internship*	0	0	0	100	-	-	1
	TOTAL	**16**	**1**	**13**	**550**	**700**	**-**	**24**
		30						

Program Elective III	
PT19 705(A)	Advertising Management
PT19 705(B)	Digital Photography
PT19 705(C)	Packaging Science
PT19 705 (D)	Green Printing
PT19 705 (E)	Colour Management System
PT19 705 (F)	Total Quality management (TQM)

***Submission of report for internship done during the break of semester 6 can be done during thestart of semester 7.**

INTERNSHIP

Students need to undergo a minimum of 10-15 days internship during their semester break in an Industry/Firm associated with rural technology and agriculture/Rural village to observe, identify and give suggestions to the problems related to Printing or allied engineering sector in the society. The Internship should give exposure to the practical aspects of the mechanical and allied engineering discipline. 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/systems 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 pass the internship is 50, split-up of the marks are as follows

Attendance	10
Co-Ordinator	20
Technical Content of the Report	30
Presentation	40

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 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;
- Final seminar, as oral presentation before the evaluation committee.

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 PRINTING TECHNOLOGY COURSE								
Subject code	**Subject Name**	**L**	**T**	**P**	**Internal**	**End Semester**	**Duration of End Semester Examination**	**Credits**
PT19 801	Print Management, Costing & Estimating	3	1	0	50	100	3	4
PT19 802	Security Printing	4	0	0	50	100	3	3
PT19 803	Program Elective-IV	3	1	0	50	100	3	3
PT19 804	Program Elective- V	3	1	0	50	100	3	3
PT19 805(P)	Seminar	0	0	6	100	0	-	2
PT19 806 (P)	Project Phase II	0	0	8	100	0		6
PT19 807(P)	Viva Voce	0	0	0	0	100	-	3
	TOTAL	**13**	**3**	**14**	**400**	**500**		**24**
		30/30						

Program Elective IV		**Program Elective V**	
PT19 803 (A)	E- Publishing	PT19 804 (A)	Newspaper and Periodical Publishing
PT19 803 (B)	Electronic Packaging	PT19 804 (B)	Packaging Management
PT19 803 (C)	Publishing Science	PT19 804 (C)	On Demand Printing
PT19 803 (D)	Printing Measurements and Control Instruments	PT19 804 (D)	Fundamentals of Electronic Media
PT 19 803(E)	Health care Packaging	PT19 804 (E)	Visual and Mass Communication
PT 19 803(F)	Display and Signage	PT19 804 (F)	Industrial Safety Engineering

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 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 work 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 a Committee

Total marks: 100, minimum marks required to pass 50

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

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**	**Minimum Duration**
NA1	N S O	70	Two Semesters
NA2	N C C	70	Two Semesters
NA3	N S S	70	Two Semesters
ii) College Level Activities			
CA1	Active Member/Office bearer of Professional Societies (Student Chapters)	30/40	Four Semesters
CA2	Elected Office bearer of Student forums	30	Two semesters
CA3	Member/Captain- College Athletic/ Games teams	20/30	Two Semesters
CA3	Executive Member of Student Clubs	20	Two Semesters
CA4	Volunteer for important College functions	20	Two Semesters
CA5	Committee member/ Organizer of Tech Fest/ Cultural Fest/ Conference	20/30	Two Semesters
CA6	Placed within top three in Paper presentation/debate/ cultural competitions etc.	30	
CA7	Placed within top three in State level Sports/Games	30	
Additional 20 points to be given for CA3/CA7 if the achievement is at the national level.			
iii) Entrepreneurship			
EA1	Any Creative Project Execution	40	
EA2	Awards for Projects	60	
EA3	Initiation of Start-ups	60	
EA4	Attracted Venture Capital	80	
EA5	Filed a Patent	80	
EA6	Completed Prototype Development	80	

iv) Self Initiatives			
SA1	Attend a National Conference	20	
SA2	Attend an Int. National Conference	30	
SA3	Published/got an Award for a technical paper.	30/40	
SA4	Organizer of student technical Conf/Competition	30	
SA5	Foreign language skills	50	
SA6	Webinar related to the Engineering/Management/Social science (Max of Ten)	2	
SA7	Online courses taken & completed	Maximum 50	10 weeks

ACTIVITY POINTS: -

The Tutor, HOD and Principal must ensure that the students have acquired the required mandatory 50 activity points (25 activity points in the case of LE students) by the end of 4^{th} and another 50 activity points by the end of 8^{th} semester. The accumulated activity points of all students must be consolidated and entered in to the university portal by the college officials upon completion of the 4^{th} semester (50/ 25 points) and the 8^{th} semester (50 points) before the commencement of the respective University examinations.

GROUP-A

MA19 100	CALCULUS AND LINEAR ALGEBRA	L-T-P-C 3-1-0-4

COURSE OBJECTIVES:

- To familiarize with functions of several variables that is essential in most branches of Engineering.
- To develop the tool of Power series for learning Advanced Engineering Mathematics.
- To develop the tool of Fourier series for learning Advanced Engineering Mathematics.
- To develop the essential tool of Matrices and Linear Algebra in a comprehensive manner.

SYLLABUS:

Module I: Sequences and Series. **(12 hours)**

Indeterminate forms and L'Hospital's rule ; Definition of sequences and series; Convergence of sequence and infinite series, Tests for convergence of infinite series-Comparison test, Ratio test, Root test, Raabe's, Logarithmic test; convergence of Alternating series (Leibnitz's test), absolute convergence.

Module II: Power Series. **(8 hours)**

Taylor's and Maclaurin's theorems with remainders, Power series, Taylor's Series, Maclaurin's series, series for exponential, trigonometric, hyperbolic and logarithmic functions. Leibnitz formula for derivative of product of two functions.

Module III: Multivariable Calculus. **(10 hours)**

Functions of several variables; Limit, continuity and partial derivatives, total derivative; Maxima, minima and saddle points; Radius of curvature, Circle of curvature, evolutes and involutes.

Module IV: Fourier Series. **(10 hours)**

Periodic functions, Trigonometric series, Fourier series, Euler Formula, Even and Odd functions, Fourier series for Even and Odd functions, Functions having arbitrary period, Fourier series of functions having arbitrary period, Half range expansions, Half range sine and cosine series.

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; Quadratic forms; Orthogonal Transformation.

COURSE OUTCOMES:

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

- Use the derivatives to find critical points, inflection points and local extrema.
- Understand the basic concept of partial differentiation and its applications in engineering.
- Develop skills in computations and applications of infinite sequences and sums.
- Expand the periodic function by using Fourier series and apply it in signals and systems.
- Use matrices and determinants for solving system of linear equations and apply it in engineering problems.

TEXT BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

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 Delhi2008.
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. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Edition, 2010.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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

MA19 200	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	L-T-P-C 3-1-0-4

COURSE OBJECTIVES:

- To introduce effective mathematical tools for the solutions of differential equations that model physical process
- To acquaint with mathematical tools needed in evaluating multiple integrals and their usage.
- To familiarize with concept of vector differentiation and vector integration.

SYLLABUS:

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

Differential equations reducible to homogeneous, Exact, linear and Bernoulli's equations, Equations of the first order and higher degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairout's type. Applications of differential equations of first order- orthogonal trajectories.

Module II: Ordinary differential equations of higher orders. **(10 hours)**

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

Module III: Multiple integrals and their applications. **(12 hours)**

Double integrals (cartesian and polar co-ordinates), Change of order of integration of double integrals, change of variables (cartesian to polar), applications: areas and volumes, triple integrals, volume of solids, change of variables (rectangular to cylindrical, rectangular to spherical polar).

Module IV: 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, physical meaning, relation between the vector differential operators.

Module V: Vector integral calculus. **(10 hours)**

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

COURSE OUTCOMES:

At the end of the course the student will be able to.

- Acquire basic knowledge of differential equations and methods of solving them.
- Model and analyse differential equations in a wide range of physical phenomena and has got applications across all branches of engineering.
- Model physical phenomena involving continuous changes of variables and parameters
- Apply the concept of vector functions and learn to work with conservative vector field.
- Apply computing integrals of scalar and vector field over surfaces in three-dimensional space.

TEXT BOOKS / REFERENCE BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002 Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons, 2006.
2. Erwin Kreyszig, Advanced engineering mathematics, 9th Edition, John Wiley & sons 2006.
3. E.A.Coddington, An introduction to ordinary differential equations, Prentice Hall 1995.
4. S L Ross, Differential Equation, 3rd ed., Wiley India 1984.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers,36th Edition, 2010.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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*

5x10 marks=50 marks

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

GROUP-B

CH19 100	ENGINEERING CHEMISTRY	L-T-P-C 3-1-0-4

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, nanomaterial's, lubricants, fuels, storage devices, etc.
- To focus the students on the chemistry of compounds resulting from pollution, waste generation and environmental degradation and to apply the knowledge in solving these current environmental problems effectively.
- To develop abilities and skills that is relevant to the study and practice of chemistry.

SYLLABUS:

Module I: **(10 Hours)**

Water: hardness, determination of hardness by edta method, softening (lime-soda and ion exchange methods), numerical problems based on hardness and lime soda method, purification of water for domestic use.

Polymers: classification, addition polymerization (free radical, cationic, anionic, and coordination mechanism of polymerisation), condensation polymerization, crystallinity in polymers (amorphous, crystalline and semi-crystalline), concept of glass transition temperature (Tg), factors affecting Tg.

Conducting polymers: introduction, synthesis, structure, properties and applications of conducting polymers like polyacetylene and polyaniline.

Module II: **(10 Hours)**

Lubricants: classification of lubricants (solid, liquid, and semisolid), Mechanism of lubrication (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 of fuels, calorific value, determination of calorific value using bomb calorimeter; numerical problems based on calorific value, liquid fuels (petroleum), refining of petroleum, cracking and reforming, petrol knock and octane number, diesel knock and cetane number, bio-diesel.

Module III: **(10 Hours)**

Nanoscience: introduction, classification of nanomaterials, synthesis of nanomaterials (hydrolysis and reduction), fullerenes and carbon, nanotubes, properties and applications of CNTs.

Green chemistry : definition, importance and limitations, twelve principles of green chemistry with their explanations and examples.

Module IV: **(10 Hours)**

Electrochemistry: electrochemical cells, salt bridge, Helmholtz double layer, single electrode potential, EMF and its measurement by Poggendorf's compensation method, determination of single electrode potential using SHE, electrochemical series and its applications, Nernst equation and its applications; numerical problems based on potential and Nernst equation, concentration cells (electrode and electrolyte concentration cells), glass electrode and pH measurement using glass electrode (Numerical problems).

Storage and fuel cells: lead acid accumulator and nickel cadmium battery, fuel cells, H_2/O_2 fuel cell, solar cells.

Module V: **(12 Hours)**

Corrosion: theories of corrosion, dry corrosion (self protecting corrosion products, pilling-bed worth rule), wet corrosion (corrosion of iron in acidic, neutral and basic conditions), galvanic corrosion and galvanic series, differential aeration corrosion, stress corrosion, factors influencing corrosion, corrosion control by cathodic protection.

Protective coatings: inorganic metallic coatings (galvanizing, tinning, cementation, electroplating), inorganic non-metallic coatings (phosphate, chromate, chemical oxide, anodizing), organic coatings (paints).

COURSE OUTCOME:

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

- Analyze 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 nanoscience and the significance of environmental protection by studying the green chemistry

- Streamline the worth of electrical storage using batteries or fuel cells by learning the electrochemistry
- List major chemical corrosion reactions and prevention methods that are used in the protection of metals

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Seymour R.B, Introduction to Polymer Chemistry, McGraw Hill, New York.
2. Billmeyar F.W, Text book of Polymer Science, Wiley Inter-science, 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 F. A. Cotton, and G. Wilkinson, Advanced Inorganic Chemistry, 3rd Ed., Wiley Eastern Ltd.
5. P. W. Atkins, Physical Chemistry, J.D. Paula, Oxford University Press.
6. V. Kumar, Introduction to Green Chemistry, Vishal Publishing House.
7. V.S. Muraleedharan and A. Subramania – Nano Science and Technology, Ane Books.
8. B. S. Bahl and ArunBahl S. Advanced Organic Chemistry, Chand & Company.
9. L. S. Brown and Thomas A. Holme, Chemistry for Engineering Students, Cengage Learning.
10. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishers.
11. Engineering Chemistry by P. Rath, Cengage Learning.
12. Engineering Chemistry by M.J Shultz, Cengage Learning, New Delhi.
13. Engineering Chemistry by R. Mukhopadhyay and S. Datta, New Age International Publishers.
14. A textbook of Engineering Chemistry by S. S. Dara and S. S. Umare, S. Chand Pvt Ltd.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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*

5x10 marks=50 marks

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

PH19 100	ENGINEERING PHYSICS	L-T-P-C 3-1-0-4

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 programmes.

SYLLABUS:

Module I: (10 Hours)

Interference: coherence, interference in thin films and wedge-shaped films (reflected system) Newton's rings; measurement of wavelength and refractive index of liquid, interference filters, antireflection coating.
Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, plane transmission grating, grating equation; measurement of wavelength, Rayleigh's criterion for resolution of grating, resolving power and dispersive power of grating.
Polarization of Light: types of polarized light, double refraction, Nicol Prism, quarter wave plate and half wave plate, production and detection of circularly and elliptically polarized light, induced birefringence; Kerr Cell, polaroid & applications.

Module II: (10 Hours)

Quantum Mechanics: uncertainty principle and its applications, formulation of time dependent and time independent Schrodinger equations, physical meaning of wave function, energy and momentum operators, eigen values and functions, one dimensional infinite square well potential , quantum mechanical tunnelling (qualitative).
Statistical Mechanics: macrostates and microstates, phase space, basic postulates of Maxwell-Boltzmann, Bose-Einstein and Fermi Dirac statistics, distribution equations in the three cases (no derivation), Fermi level and its significance.

Module III: (10 Hours)

Waves: one dimensional wave; differential equation and solution. three dimensional waves: differential equation and its solution (no derivation), transverse vibrations of a stretched string.

Acoustics: Intensity of sound, loudness, absorption coefficient, reverberation and reverberation time, significance of reverberation time, Sabine's formula (no derivation), factors affecting acoustics of a building.

Ultrasonics: production of ultrasonic waves; magnetostriction effect and piezoelectric effect, magnetostriction oscillator and piezoelectric oscillator, detection of ultrasonics; thermal and piezoelectric methods, applications of ultrasonics - NDT and medical.

Module IV: (12 Hours)

Photonics: basics of solid state lighting, LED, photodetectors, photo voltaic cell, junction and avalanche photo diodes, photo transistors, thermal detectors, solar cells; V-I characteristics.

Optic fibres: principle of propagation-numerical aperture, optic fibre communication system (block diagram), industrial, medical and technological applications of optical fibre, fibre optic sensors, basics of intensity modulated and phase modulated sensors.

Module V: (10 Hours)

Laser: properties of lasers, absorption, spontaneous and stimulated emissions, population inversion, Einstein's coefficients, working principle of laser, optical resonant cavity, Ruby laser, Helium-Neon laser, semiconductor laser (qualitative), applications of laser, holography (recording and reconstruction).

Superconductivity: superconducting phenomena, Meissner effect. Type-I and Type-II superconductors, BCS theory (qualitative), high temperature superconductors, Josephson Junction, SQUID; Applications of superconductors.

COURSE OUTCOME:

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

- Familiarized with the basic principles of Physics and its significance in engineering systems and technological advancements.
- Able to apply the theories of Physics in the field of Engineering and Technology.
- Exposed to the different branches of Physics and their field of applications in engineering.
- Able to understand the modern developments in Physics and to utilized them in technological developments.
- Able to develop the scientific attitudes and to correlate the concepts of Physics to core programs

TEXT BOOKS:

1. Physics for Engineers- M.R.Seenivasan- New Age Publishers 1996 Edition.
2. Beiser A, Concepts of Modern Physics, McGraw Hill India Ltd.
3. Brijlal and Subramanyam, A Text Book of Optics, S.Chand & Co.
4. Mehta V K, Principles of Electronics, S.Chand & Co.
5. Rajendran V and Marikani A, Physics I, Tata McGraw Hill Co Ltd.

REFERENCE BOOKS:

1. Aruldhas G, Engineering Physics, PHI Ltd.
2. Bhattacharya and Tandon, Engineering Physics , Oxford India.
3. Dominic and Nahari, A Text Book of Engineering Physics, Owl Books Publishers
4. Hecht E, Optics, PearsonEducation.
5. Mehta N, Applied Physics for Engineers, PHILtd.
6. Palais J. C, Fiber Optic Communications, Pearson Education.
7. Pandey B. K and 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 and Rewal A, Engineering Physics, Wiley India Pvt Ltd.
11. Sears and 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 (p) publishers 2000 Edition.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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*

5x10 marks=50 marks

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

GS19 100	ENGINEERING GRAPHICS	L-T-P-C 3-0-2- 4

COURSE OBJECTIVES:

- Graphics is the language of engineers and hence make the student capable of conceiving shape and geometry of various objects and to effectively communicate their design ideas through drawings and sketches as per standards.
- Enable students to prepare & understand engineering drawings.

SYLLABUS:

Module I: **(8 hours)**

Engineering Graphics – introduction - Drawing instruments and their use – lines, Lettering and dimensioning – Scales- Familiarization with Standard Code of practice for general engineering drawing. Theory of projections - Projections of points in different quadrants.

Module II: **(16 hours)**

a) 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.

b) 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: **(16 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, Tetrahedron, 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, Tetrahedron, Cone and Cylinder).

Module IV: (15 hours)

a) Development of surfaces of solids - Method of parallel line & radial line developments - 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 and combination of them.

Module V: (10 hours)

a) Introduction to perspective projections – Classification of perspective views - Visual ray and vanishing point 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, washers and screws -Locking arrangements of nuts - Bolted and screwed joints - Foundation bolts.

c) Introduction to Computer Aided Drafting (CAD) - Preparation of engineering drawings by using any software capable of drafting and modelling - Creation of simple figures like polygon and general multiline figures only.

(Module V, Part C: For internal work assessment only, not for University Examination)

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Familiarize with the Fundamentals of Engineering Drawing standards.
- Interpret 3D shapes from orthographic projections of objects and they will be able to make orthographic projections of any object.
- Draw the sectional view of the solids.
- Make developments of surfaces & solids.
- Draw the perspective projections of objects and prepare CAD drawings.

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 and R.L. Finney, Calculus and Analytic geometry, 9^{th} Edition, Pearson, Reprint, 2002.
2. John.K.C, Engineering graphics, PHI Learning Pvt, Ltd. 2009.

EVALUATION SCHEME

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% - Regularity in the class.

University Examination Pattern **(Maximum Total Marks- 100)**

PART A

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

Q 2. 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 3. 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.

PART B

Q 4. Three Questions (a), (b) and (c) of 20 marks each from module III &V, one from module III(b), one from module V(a) and one from module V(b), with choice to answer any two.

EM19 100	ENGINEERING MECHANICS	L-T-P-C 3-2-0-4

COURSE OBJECTIVES:

- To acquaint with 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.

SYLLABUS:

Module I: **(16 hours)**

Introduction to engineering mechanics - units - dimensions - vector and scalar quantities - laws of mechanics - elements of vector algebra - important vector quantities - equivalent force systems – translation of a force to a parallel position - resultant of a force system - simplest resultant of special force systems - distributed force systems - equations of equilibrium - free body diagrams - free bodies involving interior sections - general equations of equilibrium - problems of equilibrium - static indeterminacy. (Both vector and scalar formulations are to be introduced to solve problems).

Module II: **(12 hours)**

Friction – laws of friction – simple contact friction problems. Introduction to structural mechanics - trusses - analysis of simple trusses - method of sections – method of joints.

Module III: **(12 hours)**

First moment and centroid– theorems of Pappus-Guldinus - 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).
Moment of inertia of a rigid body and lamina (derivation of MI for cylinder, rod and sphere).

Module IV: **(15 hours)**

Dynamics: Rectangular and Cylindrical co-ordinate system **-** Combined motion of rotation and translation – Concept of instantaneous center – Motion of connecting rod of piston and crank of a reciprocating pump- Rectilinear translation – Newton's second law – D'Alembert's Principle– Application to 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:

After completion of the course, the student will be able to

- Gain knowledge on basic concepts of Engineering Mechanics.
- Apply the theory of mechanics in practical level.
- Get 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.
2. Timoshenko, S & Young D. H, Engineering Mechanics, McGraw Hill.

REFERENCE BOOKS:

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

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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*

5x10 marks=50 marks

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

GROUP-D

PT19 100	CONCEPTS OF PRINTING TECHNOLOGY	L-T-P-C 2-1-0-2

COURSE OBJECTIVES:

The objective of this course is to set a firm and solid foundation in Printing Engineering with strong analytical, skills and conceptual understanding of basic technologies in Printing and Packaging.

SYLLABUS:

Module I: (9 hours)

Printing (Origin and development): definition, brief history, developments, Influence in human development, Classification of Printing: conventional (with Master) and non-Impact printing (without Master); Relief, Intaglio, Planography, Screen Printing. Print production work flow: idea and concept, creative production. Industrial Production: prepress, produce printing plates; Printing: select the apt printing process; Finishing and binding: foiling, varnishing, lamination cut to size, die-cutting, perforation and punching, folding, creasing, binding, glue binding, role of printing in packaging applications. Logistics: distribution of the printed product to the end user. Division of Printing Industry: printing industry and allied industry, printing industry. Allied industries: trade shops or production houses, supplies, sales and service, equipment, related areas.

Module II: (7 hours)

Print Media: Books, Magazines, Brochures, Newspapers, Other Printed media, Future of printing. Size of the Printing Industry: Govt Sector, Private Sector, National& Abroad, Job Opportunities and Entrepreneurship: Govt Sector, Private Sector, National & Abroad. Publishing, Book Publishing, Different types of publishers, House style, Copy Editing, Proof Reading, Proof reading marks, Different types of proof, Parts of book, e-publishing, Outsourcing.

Module III: (9 hours)

Computer in Printing: basics of computer, computer operation, software and hardware, system software: operating system; application softwares, computer peripherals, computer network; LAN, WAN, MAN, wireless Networks, Advantages of networking: internet and e-mail server, connecting media, modem, browser; URL, Application of internet in printing industry; Introduction to digital imaging, types of digital printing, advantage of digital printing.

Module IV: **(7 hours)**

Images for printing: types of originals, line original, tone original, rastor images, vector images, resolution, DPI, PPI, LPI; Image input methods; scanner, types of scanners; Image manipulation: cropping, scaling; advantages of image editing software; Image formats: JPEG, GIF, PDF, TIFF, EPS, PSD, PS, ZIP/RAR.

Module V: **(7 hours)**

Colours for printing: light and colour, electromagnetic spectrum, wavelength of different colours, colour theory, additive colours, subtractive colours RGB and CMYK, colour psychology, warm colour, cool colour, neutral colour, hue, saturation, value, colour printing process; Introduction to Offset Printing: principle of offset printing, four units of an offset press, cylinder configuration: Web Offset: Advantage of offset printing.

COURSE OUTCOMES:

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

1. Understand the origin & development of Printing.
2. Explain the classifications of Printing industry.
3. Know the basic ideas of computers for printing.
4. Define the basic working principles of Printing.
5. Acquire the knowledge of colors in Printing.

TEXT BOOKS:

1. Printing Technology Fifth Edition, J Michael Adams.
2. Technology of Offset Printing, C S Misra.
3. Handbook of Printing Processes Technologies &Industries, Sudhir Guptha.
4. Modern Packaging Technology, EIRI board of consultants & engineers.

REFERENCE BOOKS:

1. Handbook of Print Media, Technologies and Production Methods Klipphan, Helmut (Ed.).
2. Hand book of Packaging Technology, By ERI Board of consultants & Engineers.
3. Introduction to Prepress design , color scanning, typesetting, fonts reproduction, By SPEIRS, Hugh.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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*

5x10 marks=50 marks

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

GROUP

EE19 101	BASICS OF ELECTRICAL ENGINEERING	L-T-P-C 2-1-0-2

COURSE OBJECTIVES:

- To impart a basic knowledge in Electrical Engineering with an understanding of fundamental concepts.

SYLLABUS:

Module I: **(7 hours)**

Elementary concepts of electric circuits: Kirchhoff's laws, constant voltage and current sources-Problems; Formation of network equations by mesh current and node voltage methods: matrix representation, solution of network equations by matrix methods- problems; star-delta conversion (resistive networks only-derivation is not needed) -problems.

Module II: **(7 hours)**

Magnetic Circuits: MMF, field strength, flux density, reluctance (definition only); comparison between 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 induced and dynamically induced emf - self inductance and mutual inductance, coefficient of coupling.

Module III: **(10 hours)**

Alternating Current fundamentals: Generation of alternating voltages-waveforms, frequency, period, average, RMS values and form factor of periodic waveform (pure sinusoidal)- numerical problems.
AC Circuits: Phasor representation of alternating quantities-rectangular and polar representation, Analysis of simple AC circuits: concept of impedance, power and power factor in ac circuits-active, reactive and apparent power solution of RL, RC and RLC series circuits-numerical problems.
Three phase systems: Generation of three phase voltages advantages of three phase systems, star and delta connection (balanced only), relation between line and phase voltages, line and

phase currents three phase power measurement by two wattmeter method (derivation is not required)- numerical problems.

Module IV: **(8 hours)**

Electric Machines: DC Generator and Motor: Construction, working principle,Back EMF.

Types of motor: shunt, series, compound (short and long), principle of operation of dc motor, applications, numerical problems (voltage - current relations only).

Transformer: Construction of single phase and three phase.

Transformers (core type only): EMF equation and related numerical problems.

Losses and efficiency of transformer for full load– numerical problems (no equivalent circuit).

Module V: **(7 hours)**

AC Motors: Three phase induction motor-squirrel cage and slip ring induction motor working principle- synchronous speed, slip and related numerical problems (No equivalent circuit). Power Systems: block diagram of power system, generation of power.

Block schematic representation of generating stations- hydro electric, thermal and nuclear power plants. Renewable energy sources: solar, wind, tidal, geo thermal (block diagram & working only).

COURSE OUTCOMES:

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

- Apply fundamental concepts and basic circuit laws to solve simple DC electric circuits.
- To understand and analyze basic magnetic circuits.
- Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state.
- To study the working principles of electrical machines.
- To get an idea about various schemes of electric power generation.

TEXT BOOKS:

1. Bhattacharya S. K., Basic Electrical & Electronics Engineering, Pearson.
2. Bird J., Electrical Circuit Theory and Technology, Routledge, Taylor

& Francis Group.

3. Del Toro V., Electrical Engineering Fundamentals, Prentice Hall of India.
4. Hayt W. H., Kemmerly J. E., and Durbin, S. M., Engineering Circuit Analysis, Tata McGraw Hill.
5. Hughes, Electrical and Electronic Technology, Pearson Education.
6. Mehta V.K. and Mehta R., Basic Electrical Engineering, S. Chand Publishing.
7. Parker and Smith, Problems in Electrical Engineering, CBS Publishers and Distributors.
8. Sudhakar and Syam Mohan, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill.
9. Suresh Kumar K. S, Electric Circuits and Networks, Pearson Education.

REFERENCE BOOKS:

1. D.P Kothari and I.J Nagrath, :Basic electrical Engineering", Tata McGraw Hill, 2010.
2. D.C Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L.S. Bobrow : Fundamentals of Electrical Engineering, Oxford University Press, 2011.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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*

5x10 marks=50 marks

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

EC19 101	BASICS OF ELECTRONICS ENGINEERING	L-T-P-C 2-1-0-2

COURSE OBJECTIVES:

- 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.
- To give basic ideas about various communication systems (no analysis required in this subject).

SYLLABUS:

Module I: **(7 hours)**

Passive components: Resistors: concepts of fixed & variable resistors, Carbon composition type resistors, metal film resistors, wire wound resistors, construction, power rating & tolerance.

Capacitors: different types, construction of mica and ceramic capacitors (disc & tubular), colorcode, electrolytic (Teflon) capacitors.

Inductors: construction of single layer, multilayer and variable inductors, principle of low power transformers.

Electro mechanical components: relays and contactors.

Module II: **(7 hours)**

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, PN Junction diode, Principle of operation, V-I characteristics, principle of working of Zener diode, Photo diode, LED and Solar cell. Bipolar Junction Transistors, PNP and NPN structures, Principle of operation, input and output characteristics of common emitter configuration (NPN only).

Module III: **(9 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.

Module IV: **(7 hours)**

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

Module V: **(9 hours)**

Radio Communication: modulation, principle of AM & FM, block diagrams of transmitters, waveforms, band width, principle of AM & FM demodulation, comparison of AM & FM, principle of super heterodyne receiver, block diagram.

Mobile communication: basic principles of cellular communications, concepts of cells, frequency reuse.

Optical communication: block diagram of the optical communication system, principle of light transmission through fiber, advantages of optical communication systems.

COURSE OUTCOMES:

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

1. List the basic electronic components such as passive and electro mechanical components.
2. Illustrate the basic concept of different types of diodes and transistors.
3. Develop simple circuits using diodes and transistors.
4. Analyze simple circuits on operational amplifiers and digital gates.
5. Explain about the basic communication systems.

TEXT BOOKS:

1. Bell D. A., Electronic Devices and Circuits, Oxford University Press.
2. Tomasy W., Advanced Electronic Communication system, PHI Publishers.

REFERENCE BOOKS:

1. Boylested R. L. and Nashelsky L., Electronic Devices and Circuit Theory, Pearson Education.
2. Frenzel L. E., Principles of Electronic Communication Systems, McGraw Hill.
3. Kennedy G. and Davis B., Electronic Communication Systems, McGraw Hill.

4. Rajendra Prasad, Fundamentals of Electronic Engineering, Cengage Learning.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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*

5x10 marks=50 marks

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

ME19 101	BASICS OF MECHANICAL ENGINEERING	L-T-P-C 2-1-0-2

COURSE OBJECTIVES:

To expose the students to the thrust areas in Mechanical Engineering and their relevance by conveying the fundamental concepts.

SYLLABUS:

Module I: **(8 hours)**

Thermodynamic processes: isobaric, isochoric, isothermal, adiabatic and polytropic : workdone and P-V diagrams; Laws of Thermodynamics, entropy, enthalpy; Ideal and real gas equations; Analysis of Carnot cycle, Otto cycle , Diesel cycle and Dual cycle; Efficiency of these cycles.

Module II: **(8 hours)**

Engines: major components and their functions (description only); Working principle of two stroke and four stroke I.C. Engines (diesel and petrol), comparison; MPFI & CRDI Engines. Power Transmission Devices: Belts and belt drives; chain drive, rope drive. Gears and gear trains: friction clutch (cone and single plate), brakes (types and applications only).

Module III: **(8 hours)**

Refrigeration: vapour compression and vapour absorption refrigeration systems, COP, Study of household refrigerator, energy efficiency rating; Refrigerants and their impact on environment. Hydraulic turbines: Pelton, Francis and Kaplan turbines (applications only). Pumps: introduction, classification, reciprocating and centrifugal (brief description and working only).

Module IV: **(8 hours)**

Sources of Energy: introduction, classification; Non-renewable energy: fossil fuels, solid, liquid and gaseous, calorific value; Renewable energy: hydroelectric, solar, wind, biomass, biogas, ocean thermal, tidal, wave and geothermal energy.

Power Plants: introduction, layout and working of diesel, nuclear, thermal and hydel power plants.

Module V: (7 hours)

Machine Tools: basic elements, Working principle and types of operations; lathe, drilling machine, shaper, planer, slotter, milling machine, grinding machine. Introduction to NC and CNC machines.

Engineering materials: classification, properties, alloys and their applications

Manufacturing process: introduction, elementary ideas of rolling and extrusion machining operations, turning, shaping, milling and drilling.

COURSE OUTCOMES:

After completion of the course, the student will be able to

1. Analyse thermodynamic cycles and calculate its efficiency
2. Illustrate the working and features of IC Engines and power transmission devices.
3. Explain the basic principles of Refrigeration and describe the working of hydraulic machines
4. Acquire knowledge about various energy sources and describe the layout and working of various Power Plants
5. Describe the basic manufacturing, metal joining and machining processes

TEXT BOOKS

1. Balachandran, Basic Mechanical Engineering, Owl Books.
2. Benjamin J., Basic Mechanical Engineering, Pentex Books.
3. Clifford M., Simmons K. and Shipway P., An Introduction to Mechanical Engineering Part I – CRC Press.
4. Pravin Kumar, Basic Mechanical Engineering, pearson publications
5. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd. Mumbai.
6. Sawhney G. S., Fundamentals of Mechanical Engineering, PHI.

REFERENCE BOOKS:

1. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi.
2. Gill, Smith and Zuirys, Fundamentals of IC Engines, Oxford and IBH publishing company Pvt. Ltd. New Delhi. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi.

3. Nag P. K., Basic and Applied Thermodynamics, Tata McGraw-Hill.
4. V Ganeshan, Internal combustion engines, Mc-Graw-Hill.
5. R K Rajput, Thermal Engineering, Laxmi Publications, 2010
6. R K Bansal, A Text Book of Fluid mechanics and hydraulic machines, Laxmi Publications.
7. P C Sharma, Production Technology, S Chand publications

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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*

5x10 marks=50 marks

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

GROUP-F

ES19 100	ENVIRONMENTAL SCIENCE	L-T-P-C 2-0-1-0

COURSE OBJECTIVES:

- 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.

SYLLABUS:

Module I: Resources **(9 hours)**

The multidisciplinary nature of environmental science: definition scope and importance, need for public awareness.

Natural resources: renewable and non-renewable resources; natural-associated problems.

Forest resources: use and over-exploitation; deforestation: case studies- timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: use and over utilization of surface and ground water; floods, drought, and conflicts over water; dams (benefits and problems).

Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources- case studies.

Food resources: world food problems, changes caused by agriculture over grazing-, effects of modern agriculture fertilizer, pesticide problems, water logging, and salinity- case studies.

Energy resources: growing energy needs, renewable and non-renewable energy resources , use of alternate energy resources.

Land resources: land as a resource, land degradation, man-induced landslides (soil erosion and desertification).

Module II: Ecosystems **(8 hours)**

Concept of an ecosystem: structure and function of an ecosystem; producers, consumers and decomposers; Energy flow in the ecosystem: food chains and food webs, ecological pyramids, ecological succession.

Different Ecosystems: introduction, types, characteristics, features, structure; Function of the ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystem (ponds, streams, lakes, rivers, ocean , and estuaries).

Module III: Biodiversity **(8 hours)**

Introduction: definition, genetic, species and ecosystem diversity; Biogeographical classification of India.

Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, national, and local level; India as mega-diversity nation; Hot spot of biodiversity.

Threats to biodiversity: habitat loss, poaching of wild life, and man-wild life conflicts; Endangered and endemic species of India; Conservation of biodiversity (In-situ and Ex- situ conservation of biodiversity).

Module IV: Environmental Pollution. **(7 hours)**

Definition, causes, effects and control measures of air pollution; Water pollution; Soil pollution; Marine pollution; Noise pollution; Thermal pollution; Nuclear hazards. Solid waste management: causes, effects and control measures of urban and industrial wastes. Waste management: role of an individual in prevention of pollution, pollution case studies. Disaster management: floods, earth-quake, cyclone and landslides.

Module V: Environment and Sustainable Development. **(7 hours)**

Sustainable use of natural resources; Conversion of renewable energy resources into other forms; Problems related to energy and energy auditing- case studies.

Water conservation: rain water harvesting and watershed management- case studies. Climate change: global warming, acid rain and ozone layer depletion- case studies. Nuclear accidents and holocaust- case studies.
Waste land reclamation: consumerism and waste products: reduce, reuse and recycle concept of products; Value education.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Raghavan Nambiar, K Text book 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.

EVALUATION SCHEME::

Internal Continuous Assessment **(Maximum Marks-100).**

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

DE19 200	CONCEPT BASED ENGINEERING	L-T-P-C 2-0-1-0

COURSE OBJECTIVES:

- To excite the student on creative design and its significance.
- To make student aware of the processes involved in the design.
- To make the student understand the interesting interaction of various segments of humanities, science and engineering in the evolution of a design.
- To get an exposure as how to engineer a design.

SYLLABUS:

Module I: **(8 hours)**

Introduction: example of different kinds of designs and designers, design problems; Definition of design; engineering design and research: importance, role of science, engineering and technology in design, design constraints, design functions, design means and design form, functional and strength designs. design form, function and strength; initiation of creative designs; initiating the thinking process for designing a product of daily use. need identification; problem statement; market survey- customer requirements; design attributes and objectives; ideation; brain storming approaches; arriving at solutions; Closing on to the Design needs.

Module II: **(8 hours)**

Product life cycle: morphology of design, introduction to system design process, stage models, design process- different stages in design and their significance; define problem, concept generation and evaluation, detailed design process, defining the design space; analogies, quality function deployment: meeting what the customer wants; evaluation and choosing of a design.

Module III: **(8 hours)**

Design for X; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. design communication; realization of the concept into a configuration, drawing and model. design for function and strength. design detailing- material selection, design visualization- solid modeling; detailed 2D drawings.

Module IV: **(8 hours)**

Prototyping- rapid prototyping; testing and evaluation of design; design modifications; freezing the design; cost analysis. engineering the design from prototype to product. planning; scheduling; supply chains; inventory; handling; manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design. list out the standards organizations. Prepare a list of standard items used in any engineering specialization.

Module V: **(7 hours)**

Product centred and user centred design. product centred attributes and user centred attributes. bringing the two closer. example: smart phone. aesthetics and ergonomics. value engineering, concurrent engineering, reverse engineering in design; culture based design; architectural designs; motifs and cultural background; tradition and design; design as a marketing tool; intellectual property rights, trade secret; patent; copy-right; trademarks; product liability.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

1. Initiate process and component elements in good and optimal design.
2. Design process stages and evaluation of the different steps involved.
3. Visualize models by combining all interdisciplinary fields.
4. Testing and evaluate the models while considering non engineering attributes.
5. Improve product quality by design survey and obtaining the patent for the product.

TEXT BOOKS/REFERENCE BOOKS:

1. Pahl G, and Beitz, W. Engineering Design: A Systematic Approach, 3rd Ed., Springer, 2007.

2. Cross N. Engineering Design Methods: Strategies for Product Design (4th edition), John Wiley and Sons Ltd., Chichester, 2008.
3. Roozenburg N.F.M., Eekels J. Product Design, Fundamentals and Methods, Wiley, Chichester, 1995.
4. James A Senn, Analysis and Design of Information system, McGraw Hill 2003.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-100)**

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

GROUP-G

CH19 100 (P)	ENGINEERING CHEMISTRY LAB	L-T-P-C 0-0-2-1

***COURSE OBJECTIVES*:**

1. To equip the students with the working knowledge of chemical principles, nature and transformation of materials and their applications.
2. To develop analytical capabilities of students so that they can understand the role of chemistry in the field of Engineering and Environmental Sciences.

SYLLABUS:

List of Experiments

(Minimum 9 experiments out of 10)

1. Preparation of urea–formaldehyde and phenol–formaldehyde resin.
2. Estimation of total hardness in a given sample of water using EDTA.
3. Estimation of chloride ions in domestic water.
4. Determination of dissolved oxygen present in a given sample of water.
5. Determination of available chlorine in a sample of bleaching powder.
6. Estimation of copper in a given sample of brass.
7. Estimation of iron in a sample of iron ore.
8. Estimation of iron in Mohr's salt using standard $K_2Cr_2O_7$.
9. Determination of flash point and fire point of an oil.
10. Preparation of buffers and standardization of pH meter.

COURSE OUTCOME:

After completion of the course, the student will be able to:-

1. Apply and demonstrate the theoretical concepts of Engineering Chemistry.
2. Synthesize of polymers like Bakelite and UF resins
3. Estimate the amount of hardness, chloride ion and dissolved oxygen in water
4. Measure the available chlorine present in bleaching powder

5. Determine the amount of metals like iron or copper present in their ores.

TEXT BOOK:

1. Dr.Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria and Sons, New Delhi.

REFERENCE BOOK:

1. Vogel, A Text Book of Quantitative Analysis, ELBS, London.

EVALUATION SCHEME

Internal Continuous Assessment **(Maximum Marks-100)**

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

PH19 100 (P)	ENGINEERING PHYSICS LAB	L-T-P-C 0-0-2-1

COURSE OBJECTIVES:

This course is designed

- To impart practical knowledge about some of the phenomena they have studied in the Engineering Physics course.
- To develop the experimental skills of the students.

SYLLABUS:

List of experiments

(Minimum 10 experiments out of 20)

1. Characteristics of Zener diode.
2. Determination of band gap energy in a semi-conductor.
3. Voltage regulation using Zener diode.
4. Static characteristics of a transistor in common emitter configuration.
5. Characteristics of photodiode.
6. Characteristics of a LED and wavelength of emitted radiation.
7. Draw the aerial and illumination characteristics of a solar cell.
8. Draw the power load and current-voltage characteristics of a solar cell.
9. Wavelength of mercury spectral lines using diffraction grating and spectrometer.
10. Dispersive power using diffraction grating and spectrometer.
11. Diameter of a thin wire or thickness of a thin wire by Air-wedge method.
12. Wavelength of sodium light by Newtons Ring method.
13. Refractive index of given liquid by Newtons Ring method.
14. Specific rotation of cane sugar solution using polarimeter.
15. Wavelength of laser using Grating. Standardize the Grating using sodium light.
16. Resolving power using diffraction grating and spectrometer.
17. To determine the angular divergence of a laser beam.
18. To measure the numerical aperture of an optical fibre.
19. Melde’s string apparatus. Measurement of frequency in the transverse and longitudinal mode.
20. Wavelength and velocity of ultrasonic waves using ultrasonic diffractometer.

COURSE OUTCOME:

After completion of the course, the student will be able to:

1. Demonstrate the understanding of the fundamental concepts in physics by setting up laboratory equipment safely and efficiently and planning and carrying out experimental procedures.
2. Demonstrate the ability to apply knowledge/skills to real world settings by identifying possible sources of error and implementing techniques that enhance precision.
3. Demonstrate critical thinking ability through analyzing and interpreting experimental data.
4. Demonstrate effective communication skills by reporting verbally and in written language the experimental data, results, and assessment of reliability.
5. Demonstrate teamwork skills by working in groups on a laboratory experiment.
6. Demonstrate ability to innovate and be creative in a laboratory experiment.

REFERENCE BOOKS:

1. Avadhanulu M. N., Dani A. A. and Pokley P. M., Experiments in Engineering Physics, S. Chand & Co.
2. Gupta S. K., Engineering Physics Practicals, Krishna Prakashan Pvt Ltd.
3. Koser A. A., Practical Engineering Physics, Nakoda Publishers and Printers India Ltd.
4. Rao, B. S. and Krishna, K. V., Engineering Physics Practicals, Laxmi Publications Sasikumar, P. R. Practical Physics, PHI.

EVALUATION SCHEME

Internal Continuous Assessment **(Maximum Marks-100)**

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

GROUP H

EE19 100 (P)	ELECTRICAL ENGINEERING	L-T-P-C 0-0-2-1

COURSE OBJECTIVES:

- To impart a basic knowledge of electrical circuits, machines and power systems.

SYLLABUS:

List of experiments

(Minimum 10 experiments out of 10)

1. Familiarization of various types of service mains: wiring installations, accessories and house hold electrical appliances.
2. Methods of earthing: measurement of earth resistance, testing of electrical installations, precautions against and cure from electric shock.
3. Practice of making different joints: britannia, married and T-joints on copper/aluminium.
4. Wiring practice of a circuit to control two lamps by two SPST switches.
5. Wiring practice of a circuit to control one lamp by two SPDT switches.
6. Wiring practice of a circuit to control one fluorescent lamp and one three pin plug socket.
7. Wiring practice of a main switch board consisting of ICDP switch, DB, MCB‘s and ELCB‘s.
8. Familiarization of various parts of electrical motors and wiring of three phase and single phase motor with starter.
9. Familiarization of energy meter and measurement of energy consumption by a single phase load.
10. Familiarization of various electrical and electronic components such as transformers, resistors, AF and RF chokes, capacitors, transistors, diodes, IC‘s and PCB.

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.
- Familiarize with the methods of earthing.

EVALUATION SCHEME

Internal Continuous Assessment **(Maximum Marks-100)**

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

EC19 100 (P)	ELECTRONICS ENGINEERING WORKSHOP	L-T-P-C 0-0-2-1

COURSE OBJECTIVES:

The objective of this course is to familiarize the students about electronic components, measuring instruments, bread board assembling, soldering tools and components etc.

SYLLABUS:

List of Exercises / Experiments

(Minimum 10 experiments out of 11)

1. Familiarization/identification of electronic components.
2. Draw electronic circuit diagram using IEEE standard symbols.
3. Familiarization/application of instruments and equipment: multimeter, power supply, CRO, function generator.
4. Assembling of electronic circuit on general purpose bread board: Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener regulator.
5. Bread board assembling: Common emitter amplifier.
6. Introduction to soldering practice: study of soldering components, solders, tools, heat sink.
7. PCB assembly and testing of full wave rectifier circuit diagram.
8. PCB assembly and testing of inverting amplifier circuit.
9. Familiarization of setting up of a PA system with different microphones, loud speakers, mixer etc.
10. Assembling and dismantling of desktop computer/laptop/mobile phones.
11. Introduction to robotics: familiarization of components (motor, sensors, battery etc.) used in robotics and assembling of simple robotic configurations.

COURSE OUTCOMES:

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

1. Identify and test various active and passive components.

2. Make use of various testing instruments and commonly used tools.
3. Build electronic circuits on breadboard.
4. Solder electronic circuits on PCB.
5. Identify various subsystems of electronic systems like PA Systems and desktop computers.

EVALUATION SCHEME

Internal Continuous Assessment **(Maximum Marks-100)**

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

ME19 100 (P)	MECHANICAL ENGINEERING WORKSHOP	L-T-P-C 0-0-2-1

COURSE OBJECTIVES:

- 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

1. Carpentry: study of tools and joints, planning, chiseling, marking and sawing practice, different joints, use of power tools.
2. Fitting: study of tools, chipping, filing, cutting, drilling, tapping, male and female joints and stepped joints.
3. Smithy: study of tools, forging of square prism, hexagonal bolt.
4. Foundry: study of tools, sand preparation, moulding practice.
5. Sheet Metal work: study of tools, selection of different gauge sheets, types of joints, trays and containers.
6. Welding**:** study of tools, different types of joints, practice.

COURSE OUTCOMES:

After completion of the course, the student will be able to

1. Obtain knowledge about various tools and operations used in carpentry.
2. Perform various fitting operations and basic operations done in a smithy.
3. Obtain sound knowledge in sheet metal work.
4. Obtain knowledge of welding and metal properties.
5. Obtain knowledge about various tools and operations used in Fitting.

EVALUATION SCHEME

Internal Continuous Assessment **(Maximum Marks-100)**

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

PT19 100 (P)	PRINTING TECHNOLOGY WORKSHOP	L-T-P-C 0-0-2-1

COURSE OBJECTIVES:

- To provide basic exposure to various printing technologies.
- To impart a basic knowledge about various printing related equipment and terminologies.

SYLLABUS:

List of Experiments

(A minimum of 8 experiments must be conducted)

1. Basics of computer for graphics designing process.
2. Identification of parts of a desk top system.
3. Identification of films, papers types used in a printing press.
4. Familiarization of various originals: line original and continuous tone.
5. Familiarization of type face and different types of font.
6. Study of color theory: draw and demonstrate the concept on paper/chart.
7. Study of paper jogging for printing.
8. Familiarize basics printing process and demonstration.
9. Demonstration: Letter press offset and Screen printing.
10. Familiarize with offset machine.

COURSE OUTCOMES:

After completion of the course, the student will be able to

1. inculcate engineering aptitude, confidence and experience towards technical skills.
2. introduce the students mentally and physically for printing industries.
3. impart knowledge and technical skills on basic printing methods.
4. know and understand the basic concepts of printing.

EVALUATION SCHEME

Internal Continuous Assessment **(Maximum Marks-100)**

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

GROUP I

CM19 100	COMMUNICATIVE ENGLISH	L-T-P-C 2-0-0-0

COURSE OBJECTIVES:

- To adapt the employability and career requirements of the industry.
- To adapt students with ease to the Industry environment by equipping with communication skills.
- To focus on overall capability in communicating ideas in an effective manner, apart from gaining academic competence.

SYLLABUS:

Module I: **(4 hours)**

Communication: definition, communication process; types of communication: formal and informal. Relevance of body language; verbal and non-verbal effective communication; communication breakdown: how to overcome communication barriers.

Module II: **(7 hours)**

Listening skills: listening and typing, focused listening, listening and sequencing of sentences, fill in the blanks, listening and answering questions. Reading comprehension: questions and answers, close exercises; Vocabulary building tasks: vocabulary trees, learning words through situations, word formation, roots, prefixes and suffixes, derivatives, synonyms and antonyms, phrasal verbs, homonyms.

Module III: **(8 hours)**

Parts of speech with special focuses on nouns & pronouns, verbs, adverbs, adjectives. subject- verb agreement. Speaking skills: linguistic and phonetics; vowels and
Consonants; 44 phonetic symbols, Diphthongs, syllables, phonemes; stress and rhythm
in connected speech: intonations and voice modulations, weak forms and strong forms, production of speech sounds in connected speech, shifting the stress for emphasis, relevance of correct pronunciation, face to face conversation of telephonic conversation.

Module IV: **(3 hours)**

Writing skills: C.V, effective resume, report, memo, business letters, structuring a report and e-mail communication.

Module V: **(4 hours)**

Developing self-esteem: presentation skills, facing the interview board, group discussions and debating skills; soft skills and time management; Psychometrics and stress management; emotional quotient.

COURSE OUTCOME:

After completion of the course, the student will be able to:

1. Not only understand the process and nature of communication but also recognize the barriers to effective communication and learn to eradicate them.
2. Attain and enhance competence in the four modes of learning: writing, speaking, reading and listening, and are able to recognize the meaning of new words based on contextual comprehension.
3. Heighten their awareness of correct usage of English grammar in writing and sounds in speaking.
4. To write official correspondences i.e., is reports, memos, letters, and e-mails and also prepare impressive curriculum vitae and resumes.
5. Improve their self-esteem and also captivate to give effective presentations in a professional and facing interview boards confidently.

REFERENCE BOOKS:

1. Meenakshi Raman and Sangeeta Sharma., Technical Communication- Principles and Practice, Oxford University press.
2. R C Bhatia, Business Communication, Ane Books Pvt. Ltd, 2009.
3. Sunita Mishra and C Muralikrishna, Communication Skills for Engineers, Pearson Education.
4. Jovan van Emden and Lucinda Becker, Effective Communication for Arts and Humanities Students, Palgrave macmillam, 2009.
5. Sanjay Kumar and Pushpalata , Communication skills, Oxford University Press, 2011.
6. Practical English Usage. Michael Swan. OUP. 1995.

7. Remedial English Grammar. F.T. Wood. Macmillan, 2007.
8. On Writing Well. William Zinsser. Harper Resource Book. 2001.
9. Study Writing. Liz Hamp- Lyons and Ben Heasly. Cambridge University Press. 2006.
10. Communication Skills. Sanjay Kumar and PushpLata. Oxford.
11. T M Farhathullah, Communication Skills for Technical Students, Orient Longman, Hyderabad.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-100)**

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

LL19 200	LANGUAGE LAB	L-T-P-C 0-0-2-0

COURSE OBJECTIVES:

- To enhance the linguistic skill of the students, keeping in view of the necessity of imparting employability skills of engineering graduates
- To Provide with a software platform which has functions like Listen- Respond-Intercommunicate-Monitor- Teacher call etc.
- To focus on the students overall ability in using English as a tool for communication.
- To overcome the inhibition factor while using English and equip them to adapt themselves to the industry environment with ease and confidence, bringing about a sort of transformation in each student.

LAB SESSIONS

1. Sessions on introduction to Linguistics and Phonetics: speech sounds and phonetic symbols; Syllables and phonemes.
2. Training to develop sharp listening skills: focused listening with emotional content; Relevance of correct pronunciation.
3. Sessions beginning with two minutes Oral Presentation on topics of their choice;

   Role plays: students take on roles and engage in dialogues/ conversations.
4. The art of effective communication: effective presentation skills; presentation tools, voice modulations, word accent, rhythm and intonation; audience analysis.
5. Vocabulary building tasks: fun games in English.
6. Relevance of body language, how to face an interview board; mock interviews; group discussions with special focus on a candidate's etiquette; debates and the art of exhibiting the interpersonal skills; public speaking.
7. Soft-skills; Emotional quotient; Training sessions; Stress Management.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

1. It brings about a consistent accent and articulacy in the pronunciation through the familiarity of phonetics.
2. advance the capability to listening English conversations
3. enhance their verbal communication skills through free speeches, role plays, activities, and interactions.
4. Better understanding of nuances of English language through audio-visual experience and speaking skills with clarity and confidence which in turn enhances their employability skills. It brings about a consistent accent and intelligibility in the pronunciation of English by providing an opportunity for practice in speaking for all the students.
5. capable of identify the meaning of novel words based on contextual comprehension.
6. Equip the students to face the interview board with confidence, making them aware of the nuisances and methodology involved in this area; help them to actively participate in debates and group discussions and face the interview confidently.
7. Prepared for creating effective presentations in front of different clusters.

SUGGESTED SOFTWARE:

1. Cambridge Advanced Learners' English Dictionary with CD.
2. The Rosetta Stone English Library.

3. Clarity Pronunciation Power.
4. Mastering English in Vocabulary, Grammar, Spellings, Composition.
5. Dorling Kindersley series of Grammar, Punctuation, Composition etc.
6. Language in Use, Foundation Books Pvt Ltd with CD.

7. Learning to Speak English - 4 CDs.
8. Microsoft Encarta with CD.
9. Murphy's English Grammar, Cambridge with CD.

REFERENCE BOOKS:

1. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. English Pronouncing Dictionary Daniel Jones Current Edition with CD.
3. Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
4. A Practical course in English Pronunciation, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.

EVALUATION SCHEME:

Internal Continuous Assessment ***(Maximum Marks-100)***

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

EN19 301	ENGINEERING MATHEMATICS III	L-T-P-C 3-1-0-4

***PRE-REQUISITE*:** Calculus and Linear Algebra

***COURSE OBJECTIVES*:**

- ✓ To provide a quick overview of the concepts and results in complex analysis that may be useful in engineering. To introduce the concepts of linear algebra and Fourier transform which are wealth's of ideas and results with wide area of application

***SYLLABUS*:**

Module I: Linear Algebra – (Proofs not required) (11 hours)

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

Module II: Fourier Transforms (11 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.

Module III: Laplace Transforms (10 hours)

Laplace transform-Elementary Properties-Inverse Laplace transform-convolution theorem- Solution of ordinary differential Equations using Laplace transform.

Module IV: Series Solutions of Differential Equations (10 hours)

Power series method for solving ordinary differential equations – Frobenius method for solving ordinary differential equations – Bessel's equation – Bessel functions – Relation between Bessel functions.

Module V: 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 ; F1(x,p) = F2(y,q) ; Clairaut's form, z = px + qy + F(p,q) ; Legrange's form, Pp + Qq =R-Classification of Linear PDE's – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables.

COURSE OUTCOMES:

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

1. Develops the essential tool of linear algebra in a comprehensive manner.
2. Use tools for Fourier Transforms.
3. Use tools for Laplace transforms and apply it in solution of differential equations.
4. Acquire the knowledge of power series for learning advanced Engineering Mathematics.
5. Use mathematical tools for the solution of Partial differential equations that models physical processes.

***TEXT BOOKS*:**

1. Bernaed Kolman, David R Hill, Introductory Linear Algebra, An Applied First Course, Pearson Education.
2. Erwin Kreysig, Advanced Engineering Mathematics ,9th Edition, John Wiley & Sons,2006.
3. P.RameshBabu,R.Anandanatarajan ,Signals and Systems, Scitech Publications(India) Pvt.ltd, 4th Edition.
4. B.S.Grewal,Higher Engineering Mathematics ,Khanna Publishers,35th Edition.

***REFERENCE BOOKS*:**

1. N.P.Bali, Manish Goyal, Text Book of Engineering Mathematics, Laxmi Publications, Reprint 2010.
2. Wylie C.R and L.C. Barrett, Advanced Engineering Mathematics, McGraw Hill.
3. S.J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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 **5x10 marks=50 marks**.

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

PT19 302	COMPUTER PROGRAMMING IN C	L-T-P-C 2-0-2-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To impart the basic concepts of computer and Information Technology.
- To develop skill in problem solving concepts through learning C programming in practical approach

SYLLABUS:

Module I: **(9 hours)**

Introduction to Computers: CPU, Memory, input-output devices, secondary storage devices, Processor Concepts – Machine language, assembly language, and high level language. Inside a PC, Latest trends and technologies of storage, memory, processor, printing etc. Concept of Program and data, System software – BIOS, Operating System- Definition-Functions-Windows, and Linux. Compilers and assemblers, Computer networks, LAN, WiFi

Module II: **(11 hours)**

Basic elements of C- Flow chart and algorithm – Development of algorithms for simple problems. Structure of C program – Preprocessor directives- Header files- Library functions-Operators and expressions – Procedure and order of evaluation – Input and Output functions. While, do-while and for statements, if, if-else, switch, break, Programming examples.

Module III: **(11 hours)**

Arrays-Introduction to Arrays-Declaration, Initialization – One dimensional array –Defining and processing arrays - two dimensional and multidimensional arrays – application of arrays.
Structures- Declaration, definition and initialization of structures - union.

Module IV: **(12 hours)**

String operations- Basics- operations-length, compare, concatenate, copy –**Functions**-Declaring, defining, and accessing functions – parameter passing methods – passing arrays to functions - **Recursion** – Storage classes – extern, auto, register and static- Programming examples

Module V: **(9 hours)**

Pointers- Concepts, declaration -initialization of pointer variables-simple examples. **Files**-Concept of a file – File Operations-File pointer

COURSE OUTCOME:

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

1. Understand functionalities of digital computers and different kinds of software's.
2. Identify appropriate C language constructs to solve problems.
3. Design and implement applications using arrays, structures and strings.
4. Analyse problems, identify subtasks and implement them as functions.
5. Develop and implement applications in C using pointers and learn the basic concepts of file system

TEXT BOOKS:

1. P. Norton, Peter Norton's Introduction to Computers, Tata McGraw Hill, New Delhi.
2. E. Balaguruswamy, Programming in ANSI C, 3rd ed., Tata McGraw Hill, New Delhi, 2004
3. Rajaraman V , Computer basics programming in C, PHI

REFERENCE BOOKS:

1. B. Gottfried, Programming with C, 2nd ed, Tata McGraw Hill, New Delhi, 2006
2. B. W. Kernighan, and D. M. Ritchie, The C Programming Language, Prentice Hall of India, New Delhi, 1988
3. K. N. King. C Programming: A Modern Approach, 2nd ed., W. W. Norton & Company, 2008
4. S. Kochan, Programming in C, CBS publishers & distributors

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

40% - Test-1 (For Theory)

40% - Test-2 (For Lab, Internal Examination)

10% - Fair Record

10% - Regularity

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.

PT19 303	PAPER & INK	L-T-P-C 4-0-0-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- ✓ To study the classification, properties and testing of Paper.
- ✓ To study the classification, properties and testing of Printing Inks.

SYLLABUS:

Module I: **(9 Hours)**

Introduction to Paper-Raw materials- Nature of paper- cellulose, fibers, non-fibers and additives. Stages of paper making- Debarking, chipping, Screening, Pulping, Washing, Refining, Stock preparation. Pulp Additives –water, sizing agents, fillers and Coloring materials. Paper making machines-different sections, finishing operations, coating, board making-furnish, manufacture and finishing.

Module II: **(9 Hours)**

Recycled paper- Introduction recycling process, fiber preparation- screening, centrifugal cleaning, flotation, washing, deinking plant functions, continuous drum pulper, pre-screening and cleaning, primary flotation, cleaning, fine screening, thickening, disperging, brightness control, post flotation, light weight cleaning, washing, thickening and storage. Properties of paper for offset, flexography, gravure, screen and other printing processes.

Module III **(10 Hours)**

Printing ink- Colorants : Pigment classifications, preparations. Inorganic: white and colored, carbon black, metallic, ultramine and fluorescent. Organic: Diarylide yellow, hansa yellow, rodamine, lithol, rubine toner, phalocyanine blue and green and alkali blue, benzidine orange, toluidine red and lake red. Dyestuffs: classification, preparation and properties and uses, acid, basics, solvents and disperse dyes. Oils: classification, preparation and properties and uses of drying semi - drying and non-drying oils. Resins: natural: rosin and its derivatives, Gum Arabic, synthetic resins: epoxy resins, acrylic resins and varnishes. Solvents: aliphatic and aromatic hydro carbon, alcohol, esters, glycols &

ketones. Additives- properties and applications Driers, waxes, antioxidants, plasticizers, wetting agents, deforming agents and anti- skinning agents.

Module IV: (10 Hours)

Paste inks: single roll mill, roll mill, triple roll mill, twin horizontal mixer, zarm stirrer- liquid inks: ball mill, bead mill, and attritor. Flow chart for ink manufacturing, weighting, mixing, grinding, testing and packing.

Special inks and drying mechanism: heat sets, quick sets, gloss, magnetic and water based inks, Radiation curable inks-IR, UV & EB, Raw materials to constitute the inks and the equipment's used for drying. Different types of ink drying mechanism. Ink problems-related to major printing processes-causes and remedies.

Module V: (14 Hours)

Paper properties & Testers -Physical properties, Strength properties, optical properties, chemical properties and printing properties. Optical Property Testers – Brightness meters, gloss meters, opacimeters, Printability property testers – Absorbency testers, , Dynamic property testers, expansimeters, coefficient-of-friction testers, Hydrostatic testers, linting testers, moisture meters, picking testers, relative humidity testers**.** End use property testers – Abrasion testers, adhesion testers, adhesive testers, basic weight testers, book strength testers, bursting strengths testers, compression testers, crush resistance testers, folding endurance testers, micrometers, puncture testers, roll coating testers, stiffness testers, tearing strength testers, tensile strength testers, wet strength testers, wick resistance testers

Properties of Ink and Ink testers – Introduction-Viscosity, tack, color, gloss, rub resistance, length, dry characteristics, and finess of grind. Working property testers – colorimeters & spectrophotometers, dispersion testers, drying time testers, drying time tester, film applicators, Ink film thickness gauges, film thickness gauge accessories, fineness-of-grind testers, Mixing scales, tack testers, tack tester accessories, viscometers, rotational viscometers, viscometer accessories, viscosity control instruments, viscosity cups, viscosity tubes, weight-per-gallon cups.

COURSE OUTCOMES:

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

1. Know the basic idea of Paper and its preparation.
2. Acquire the knowledge of recycling of papers.

3. Apply the suitable components for making printing ink.
4. Explain the suitable drying mechanism of ink and special inks used in printing.
5. Identify the Paper and Ink properties and its testing.

TEXT BOOKS:

1. Adams J.M, Faux,D.D and Rieber L.J, Printing Technology, Delmar Publishers, NewYork
2. R.H. Leach, The Printing Ink Manual, fifthe edition, Chapman & Hall, London.
3. Claudia G Thompson (1992) "Recycled Papers" The M I T Press, Cambridge.
4. Robert F Reed, What the Printer should know about inks, GATF
5. Eves Ian (1991) "Paper" Blueprint, London.
6. Finley Charles (1997) "Printing Paper and Inks" Delmar Publishers, New York

REFERENCE BOOKS:

1. Clifwool, A Manual for Flexographic inks, Fishbum Printing ink co. Ltd
2. Fonald E Tood, Printing inks, Pira International, United Kingdom
3. R.J. McGill, " Measurement and control in paper making", Adam Hilger Ltd.
4. D.Venkateswaralu, Paper for printing and packaging. SS Graphics

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home-work, 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.

PT19 304	GRAPHIC ARTS TECHNIQUES	L-T-P-C 4-0-0-3

***PRE-REQUISITE*:** Nil

COURSE OBJECTIVES:

- ✓ To impart the basic idea of printing industry and Printing processes.
- ✓ To obtain knowledge about Printing materials and imaging techniques.

SYLLABUS:

Module I: (10Hours)

Types of process camera-Mechanical and optical principles–lens-focal length-image formation-lens aberrations-factors governing design and layout of studio-illumination, reflection and transmission – film processing- lith and rapid access film processing –replenishment- Reciprocity failure-intermittency effect-contact photography.

Module II: (10 Hours)

Digital photography:- Origins of digital photography, image scanning with digital cameras, demands on the resolution, special features of the digital camera – tone value quantization, focal length and lenses, aspect ratio, link-up to a computer. Digital photography and color management

Module III: (8 Hours)

Planning layout and Film assembly-Basic steps involved in planning a layout, Factors to be considered while planning a layout, positive &-ve film assembly, Planning of multicolor work, imposition consideration for sheet fed & web fed press.

Module IV: (12 Hours)

Planographic plates- The plate base- cross section of an aluminum plate, cross section of a plastic plate. Anodized aluminum, plate washes. Paper plates, paper aluminum laminates, plastic plates. Light sources for plate making-spectral data for various light sources, metal halide, mercury lamps, pulsed-xenon, laser.

Module V: **(12 Hours)**

Negative working plate-additive pre-sensitized plates, subtractive diazo PS plates, photopolymer pre-sensitized plates, aqueous developable plates, driographic plates, multimetal plates. Producing a multimetal plate. Types- bimetallic, trimetallic. Diffusion and transfer methods, electrostatic. Positive working lithographic plates- presensitized plates, Baking of Positive plates – photo direct plates. Screen less lithography, laser exposed plates, deep etch plates and their purposes. Waterless plate.

COURSE OUTCOME:

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

1. Know the basic idea of processes Camera and its parts.
2. Acquire the knowledge of digital photography in printing.
3. Explain the basic principles of layout preparation.
4. Differentiate the printing plates and its types.
5. Work with negative and positive lithographic plates.

TEXT BOOKS:

1. Nelson R Eldred, Chemistry for the Graphic arts, GATF, USA, 1992.
2. Prakash Shetty, Science and Technology of Printing Materials, MJP Publishers, Chennai, 2008.
3. Adams J.M, Faux,D.D and Rieber L.J, Printing Technology, Delmar Publishers, NewYork.
4. Heigh. M. Speir, Introduction in Printing Technology.

REFERENCE BOOKS:

1. Hand book of Modern halftone photography, perfect graphic arts, USA
2. Jack Eggleston, Sensitometry for photographers, focal Press, London
3. Woddiff Thomas , J R.SPSE handbook of photographic science and engineering, John Wiley &Son
4. Puri B.R, Sharm L.R and Pathania M.S, Principals of PhysicalChemistry, Vishal

Publishing Co,Jalandhar, 2002.

5. Anthony Bristow, Advances in Printing Sciences and Technology, Vol. 24-J.
6. A.S. Porter.- Lithographic Press Work
7. Handbook of Print Media, Technologies and Production Methods Kipphan, Helmut Ed.)

EVALUATION SCHEME

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 305	GRAPHIC DESIGN AND ELECTRONICS COMPOSITION	L-T-P-C 4-0-0-3

***PRE-REQUISITE*:** Concepts of Printing

COURSE OBJECTIVES:

- ✓ To impart the basic concept of Color.
- ✓ To study the design principle and typography.
- ✓ To study the Desktop software's for pre-press jobs.

SYLLABUS:

Module I: (10 Hours)

Color: Understanding color, Visual system-eyes and visual sense, structure and functioning of human eye, electromagnetic response, Cones and rods, temporal properties, Perceived color. Color & color theory – Additive & subtractive -Terms to describe color, - color separation technique. GATF, color triangles & color circle, color spaces, color matching, color original, method of color measurement, color Gamut.

Module II: (10 Hours)

Printers measurement systems-Word spacing material, Line spacing material
Composing a line of type- Centering a line of type, straight composition, storing the form
Basic typographic forms – Spacing, word spacing, letter spacing, mark up, copy fitting
Casting up, Casting off - word count method, character count method, en-count method, calculations.

Module III: (12 Hours)

Importance of graphic design. Elements of design. Principles in designing, visual ingredients of graphic design, point, line, graphic space, texture, color, scale, balance and contrast. Role and function of color in design. Legibility and readability, monograms and trademarks. Limitations of binding, finishing and ancillary processes as they affect design. Selection and specification of ink & paper in relation to design specifications and to the production process decided.

Module IV: **(12 Hours)**

Copy for printing –verbal copy, copy marking, copy fitting: - Digital copy fitting, Traditional method. Digital copy fitting- Shrink the page to fit, Reword the text, Reduce the font size, Space between paragraph, Space between lines, Inter character spacing, White space management.

Traditional method:- text matter, calculation. Proofing stages, proof correction marks, correction of type set matter. Text transferring data – capture device, telecommunications, modems, ISDN. Typesetting commands - code syntax, menu driven systems. General rules for Page makeup. Page makeup of book work, newspapers, magazines, pamphlets.

Module V: **(8 Hours)**

Composition Software - Automatic Page Make up, Text and graphics Integration, Page display, WYSIWYG. Post Script (PS): Introduction. PostScript Fundamentals-Structure, code, the user space, Encapsulated PS, Images, color Adobe acrobat. Page make-up software for desk top publishing - Word processing – heavy duty program, medium duty programs, light duty program, Graphic programs Optical Character Recognition (OCR) software, PageMaker, Illustrator, InDesign, Quark-Express, Ventura Publisher, Photoshop.

COURSE OUTCOME:

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

1. Know about the basics of color and visual system.
2. Calculate with printers measurement system.
3. Understand the principles of design.
4. Correct the mistakes in a copy using different proofing stages.
5. Handle different composition softwares.

***TEXT BOOKS*:**

1. Speirs H (1998) "Introduction to Prepress" Pira International, UK
2. David Bergsland (1997) "Printing in a Digital World " Delmar Publishing, Albany

3. Kleper M.L. (1990) "Illustrated hand book of desk top publishing and type setting" Wind Crest, Pennsylvania
4. Art & Print production – N N Sarkar
5. Hand book of printing process - Deborah L Stevenson

REFERENCE BOOKS:

1. Sohick (Cd)- Fundamentals of Copy & Layout- A.C. Book (Ac)
2. Craig- Production for the Graphic Designer
3. Muray (Ray)- How to brief designs & buy print
4. David A.Akar & John G. Myers.- Advertisement management
5. Arthur Robinson, Randall Sale & J.K. Morrison- Elements of Cartography.
6. Leon O Chus & Pen Min Lin C.A.- Copy Preparation

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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.

EN19 306	LIFE SKILLS AND ETHICS FOR ENGINEERS	L-T-P-C 2-0-2-0

***PRE-REQUISITE*:** Nil

LIFE SKILLS

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

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.
- ✓ To inculcate critical thinking process.
- ✓ To prepare them on problem solving skills.
- ✓ To provide symbolic, verbal, and graphical interpretations of statements in a problem description.
- ✓ To understand team dynamics & effectiveness.
- ✓ To create an awareness on Engineering Ethics and Human Values.
- ✓ To instill Moral and Social Values, Loyalty and also to learn to appreciate the rights of others.
- ✓ 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 & Right brain, Convergent & Divergent Thinking, Critical reading & 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 thinking, getting acquainted, Clarifying expectations.

Group Problem Solving, Achieving Group Consensus.

Group Dynamics techniques, Group vs Team, Team Dynamics, Teams for enhancing productivity, Building & Managing Successful Virtual Teams. Managing Team Performance & Managing Conflict in Teams.

Working Together in Teams, Team Decision-Making, Team Culture & Power, Team Leader Development.

Module IV **(10 hours)**

Morals, Values and Ethics, Integrity, Work Ethic, Service Learning, Civic Virtue, Respect for

Others, Living Peacefully.

Caring, Sharing, Honesty, Courage, Valuing Time, Cooperation, Commitment, Empathy, Self-Confidence, Character Spirituality, Senses of 'Engineering Ethics', variety of moral issued, 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, Balanced outlook on.

The challenger case study, Multinational corporations, 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, style, followers, crises.

Growing as a leader, turnaround 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:

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

1. Define and Identify different life skills required in personal and professional life which will enable them to make effective presentations and Face group discussion.
2. Critically think on a particular problem and Solve problems.
3. Work in Group & Teams
4. Handle Engineering Ethics and Human Values.
5. Become an effective leader.

TEXT BOOKS :

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

EVALUATION SCHEME

Internal Evaluation

(Conducted by the College)

Total Marks: 100

Part – A

1. Group Discussion – Create groups of about 10 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation is as follows;

(i) Communication Skills – 20 marks (ii) Subject Clarity – 10 marks (iii) Group Dynamics - 10 marks (iv) Behaviors & Mannerisms - 10 marks

(Marks: 50)

Part – B

2. Presentation Skills – Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation is as follows;

(i) Communication Skills* - 20 marks (ii) Platform Skills** - 20 marks (iii) Subject Clarity/Knowledge - 10 marks **(Marks: 50)**

PT19 307(P)	PRINTING SOFTWARE LAB	L-T-P-C 0-0-3-1

* Language fluency, auditability, voice modulation, rate of speech, listening, summarizes key learnings etc.

** Postures/Gestures, Smiles/Expressions, Movements, usage of floor area etc.

***PRE-REQUISITE*:** Nil

COURSE OBJECTIVES:

- ✓ To Develop a concept in designing and designing software's.
- ✓

SYLLABUS:

List of Experiments

(A minimum of 8 experiments must be conducted)

1. Familiarization with key board.
2. M.S word- justification works, column work, single column double column, fonts & type style changing, copy, cut &paste command, word act.
3. Page maker –familiarizing tools and practicing.
4. Page maker –designing –visiting card, page make up of pamphlets, page make up of advertisements, folders, journals, book work, picture and text manipulation, table work setting, tabular work setting.
5. Adobe photo shop-familiarizing and practice with photo shop tools.
6. Adobe photo shop- design a work using layers and masking, picture editing , scanning the image, converting image formats, resizing the image and picture &text manipulation.
7. Corel draw- working principle designing and practicing.
8. Corel draw- design a logo, visiting cards, posters etc.
9. Adobe In Design- working principle, designing &practicing.
10. Adobe In Design-design a work.
11. Adobe Illustrator- working principle, designing &practicing.
12. QuarkXPress - working principle, designing &practicing.
13. Comparing various outputs –Dot matrix, Inkjet printer, Laser printer, Digital printer.

COURSE OUTCOMES:

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

- Familiarize with computer keyboards.
- Identify and Handle the page maker software with different tools.
- Manage the preparations of books and journals.
- Make designs using photoshop software.
- Handle the Adobe illustrator, Corel draw and the Quark express software's.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern **(Maximum Marks-100)**

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

20% - Viva voce

10% - Fair record

PT19 308(P)	PRE-PRODUCTION LAB	L-T-P-C 0-0-3-1

***PRE-REQUISITE*:** Nil

COURSE OBJECTIVES:

- ✓ To be equipped with Planning layout, film assembly and Platemaking.

SYLLABUS:

<u>List of Experiments</u>

(A minimum of 8 experiments must be conducted)

1. Layout of facilities and workflow of Plate making department.
2. Layout Preparation, Study of Leading edge, Margin and registration Process.
3. Terminology for impositions, Layout for sheet and half sheet work
4. Key sheet Preparation for Sheetfed and Web-offset works.
5. Sheet work impositions- 4 page layout, 8 page layout, 16 page layout, 32 page layout.
6. Half Sheet work impositions-4 page layout,8 page layout,16 page layout,32 page layout.
7. Color stripping methods.
8. Page makeup- folders and Pamphlets.
9. Page makeup- Newspaper and Bookwork.
10. Preparation of Pre sensitized plates.
11. Page imposition using imposition software’s.
12. Study of effect of exposure and development factors on quality of the plate.

COURSE OUTCOMES:

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

- Understand the workflow of plate preparation.
- Draw the layout sheets for printing.
- Prepare the key-sheets for sheetfed and web-offset printing.
- Explain the stripping process in printing.
- Handle the plate preparation using traditional way as well as using software.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern **(Maximum Marks-100)**

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

20% - Viva voce

10% - Fair record

EN19 401	ENGINEERING MATHEMATICS IV	L-T-P-C 3-1-0-4

***PRE-REQUISITE*:** Nil

COURSE OBJECTIVES:

- To deal with the methods for collection, classification and analysis of numerical data.
- To describe the characteristics and compute probabilities using both discrete and continuous probability distributions.
- To develop hypothesis testing methodology using test statistics.
- To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

SYLLABUS:

Module I: Bivariate Probability Distributions **(10 hours)**

Two random variables-Joint probability mass function- Joint probability density function-Marginal probability distributions-Conditional probability distributions-Independence of random variables-Joint distribution function - Bivariate moments -Conditional expectation- Conditional variance

Module Il: Probability Distributions **(10 hours)**

Random variables - Mean and Variance of probability distributions - Binomial Distribution - Poisson Distribution - Poisson approximation to Binomial distribution - Hypergeometric Distribution – Geometric Distribution - Probability densities - Normal Distribution - Uniform Distribution - Gamma Distribution.

Module III: Theory of Distributions **(12 hours)**

Population and Samples - Sampling Distribution - Sampling distribution of Mean (s known) - Sampling Mean (s known) – Sampling distribution of Mean (σ unknown) - Sampling distribution of Variance - Interval Distribution – Confidence interval for Mean - Null Hypothesis and Test of Hypothesis - Hypothesis concerning one mean – Hypothesis concerning two means - Estimation of Variances - Hypothesis concerning one variance - Hypothesis concerning Two variances - Test of Goodness of fit.

Module IV: 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 V: 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 – Evaluation of real definite integrals.

COURSE OUTCOME:

1. Acquire the knowledge of basic ideas of joint probability distributions.
2. Acquire the knowledge to describe the characteristics and compute probabilities using both discrete and continuous probability distributions.
3. Develops the skills of hypothesis testing methodology using test statistics.
4. Distinguish to compute the differentials of various complex function in various engineering problems.
5. Acquire the mathematical tools of integration of functions of complex variable that are used in various techniques dealing engineering problems.

TEXT BOOKS:

1. Richard A Johnson, CB Gupta, Miller and Freund's Probability and statistics for Engineers,
2. Wylie C.R and L.C. Barret, Advanced Engineering Mathematics, McGraw Hill.
3. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers,35th Edition

REFERENCE BOOKS:

1. ErwinKreszig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
2. N Bali, M Goyal, C Watkins, Advanced Engineering Mathematics, A Computer

Approach, 7e, Infinity Science Press, Fire Wall Media.

3. William Hines, Douglas Montgomery, avid Goldman, Connie Borror, Probability and Statistics in Engineering, 4e, John Wiley and Sons, Inc.
4. Sheldon M Ross, Introduction to Probability and Statistics for Engineers. And Scientists, 3e, Elsevier, Academic Press.
5. H Parthasarathy, Engineering Mathematics, A Project & Problem based approach, Anne Books India.
6. B V Ramana, Higher Engineering Mathematics, McGraw Hill.
7. J K Sharma, Business Mathematics, Theory and Applications, Anne Book, India.
8. Babu Ram, Engineering Mathematics Vol. II, 2nd edition, Pearson Education.
9. Sastry S.S., Advanced Engineering Mathematics-Vol. I and II., Prentice Hall of India.
10. Veerarajan.T, Probability, Statistics and Random Processes, Tata McGraw- Hill, 2nd edition.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 402	OFFSET TECHNOLOGY	L-T-P-C 3-0-1-4

PRE-REQUISITE: Concepts of Printing

COURSE OBJECTIVES:

- To deals about the working operation of a sheet fed offset and web offset machines
- Helps to understand about a basic idea of lithographic process.

SYLLABUS :

Module I: **(10 hours)**

Principles of lithography & offset printing. Advantages &limitations. Units of offset presses- Infeed, registration, printing & delivery units. sheetfed offset and web offset, duplicators, single color and multi color, Direct imaging presses. Various press configurations- Inline presses, stack, blanket to blanket, common impression cylinder. Feeder system - Types of feeders-single sheet & stream feeding. Feeder head components-pile table, pile height, air blast nozzles, forwarding pick up sucker, rear pickup suckers, separator brushes & fingers. Sheet control devices-conveyor assemblies, conveyor tape, hold down rods. Sheet separation system-friction, pneumatic. Web offset - Introduction, plate cylinder, Blanket cylinder.

Module II: **(8 Hours)**

Sheet detectors- No sheet detectors, early or fast detectors, cross sheet detectors, double sheet detectors. Sheet detector mechanisms-mechanical types, electromechanically type, pneumatic type. sheet registration unit- registration devices-front lay, side lay-push &pull type. Side lay settings.
In feed section –sheet insertion system-tumbler gripper, rotary gripper, swing arm gripper, pin type gripper, spring gripper-compression spring &tension spring. Plate cylinder-cylindrical design, cylinder driving body, cylinder gap, plate clamping, plate punching, bearer contact cylinder, bearer gap cylinder Introduction to impression cylinder. Transfer cylinder, chain transfer, single drum transfer, three drum transfer. Delivery unit-skeleton wheels, Transfer drum, Delivery cylinder. types of delivery systems.

Module III: **(10 Hours)**

Dampening system-introduction, fountain roller, dampening feed roller, dampening solution composition, alcohols, use of alcohols, alcohol substitutes, storage of alcohol, PH of dampening solution, conductivity of dampening solution. Different types of dampening system- levy flap dampening systems, continuous flow dampening systems, brush dampening using flick blades, -inker feed systems, plate feed systems, Spray-bar dampening systems. Critical metering nip, Reverse slip nip. Damper setting.

Module IV: **(12 Hours)**

Inking unit-introduction –ink duct, ink fountain, ink feed roller, oscillating roller, reciprocating rollers, form rollers, Intermediate rollers. Dwell time, ductor shock. Ink film thickness. Drum type inking system. Blanket- types of blanket**.** Blanket thickness. Blanket hardness**.**

Pre make ready, make ready**.** Multicolor sheet fed press-transfer roller-three &five cylinder system. Color sequence in two color and multi color operations. Printability and runnability, Wet on wet printing. Wet on dry printing. Printing unit problems. Inking unit problems. Paper problems. Blanket troubles.

Module V: **(12 Hours)**

Single- roll stand, multiple roll stand, dancer roller, Lug air shaft, continuous roll feeding devices-Flying Pasters-splicing sequence on flying paster. Zero speed splicer-splicing sequence on a zero-speed paster. Preparing a splice. Splice template, infeed operation. Dryers-introduction, function, setting of quick set ink, setting of heat set ink. Types of dryers, removal of solvent-ladder air from web, putting a controlled ripple in the web. Chill rolls-Introduction, function, types of roll system. The evolution of chill roll design, chill roll plumbing, Average web temperature after chilling, side-to-side temperature variation after chilling. Folders-Introduction, folding principles, parts of folder, combination folder, ribbon folder, double-former folder, the mechanics of folding process of jaw fold, chopper fold mechanisms. Operation of collect cylinder, press folders, double former pre-folder, flow folders, insert folders.

Inline finishing -gluers, Pattern perforating and numbering units, ink agitators, plate scanners, scanning densitometer, Perfectors, cut off controls, stroboscope, synchroscope. Press room safety.

COURSE OUTCOMES:

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

1. Identify the Basics of offset Printing process;
2. Analyze working principle of the sheetfed press as well as the infeed unit.
3. Apply the principles of Dampening system in the Printing.
4. Handle the Inking systems in the Printing.
5. Acquire the Principles of web offset printing systems.

TEXT BOOKS: -

1. Dejdas L.P and Destree T.M, Sheetfed Offset Press Operating, GATF,USA, 1998.
2. A S Porter, Manual for Lithographic Press Operation.
3. David B.Crouse, Robert J Schneider,Jr, Web offset press operating.
4. C.S.Mishra ,Offset M/C II.
5. A.S .Porter, Manual for Lithography press operator

REFERENCE BOOKS: -

1. Crowhurst L, Small Offset: Press and Ioeration, GATF,USA,1982
2. GATF Staff, Solving Sheetfed Offset Press Problems, GATF, USA, 1994
3. Crouse D.B and Schneider R J, Web offset Operating, GATF,USA,1989
4. GATF Staff, Solving Web Offset problems, GATF,USA, 1990

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 403	STRENGTH OF MATERIALS	L-T-P-C 3-1-0-3

***PRE-REQUISITE*:** Nil

COURSE OBJECTIVES:

- To impart knowledge on common building materials and methods of construction
- To enable the students to calculate stresses and strains generated in objects due to different kinds of forces.

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SYLLABUS

Module-I **(8 Hours)**

General Introduction to Civil Engineering. Surveying principles and objectives- leveling definition principles –

Building materials –bricks/blocks, cement, concrete, steel - properties and types.

Building construction - masonry, cement mortar, PCC and RCC

Foundations; Bearing capacity of soil; Functions of foundations, Types - shallow and deep.

Module-II **(10 Hours)**

Introduction to analysis of deformable bodies- Stress – stresses due to normal, shear and bearing loads – strength design of simple members. Material behavior – uniaxial tension test – stress-strain diagrams concepts of orthotropy, anisotropy– Hooke's law for linearly elastic isotropic material under axial and shear deformation. Deformation in axially loaded bars – thermal effects – statically indeterminate problems – principle of superposition.

Module-III **(10 Hours)**

Definition of stress and strain at a point (introduction to stress and strain tensors and its components only) – Poisson's ratio – biaxial and triaxial deformations – Bulk modulus - Relations between elastic constants. Shear force and bending moment diagrams by direct approach. Differential equations between loads, shear force and bending moment. Shear force and bending moment diagrams.

Module-IV **(10 Hours)**

Deflection of beams: Moment-curvature relation – assumptions and limitations - double integration method – Macaulay's method - superposition techniques – moment area method and conjugate beam ideas for simple cases**.** Stresses in beams: Pure bending – flexure formula for beams assumptions and limitations – section modulus - flexural rigidity - economic sections – beam of uniform strength.

Module-V **(10 Hours)**

Torsion: Shafts -solid and hollow - torsion theory of elastic circular bars – assumptions and limitations – polar modulus - torsional rigidity shaft design for torsional load.

Theory of columns: Buckling theory –Euler's formula for long columns – assumptions and limitations – effect of end conditions - slenderness ratio – Rankin's formula for intermediate columns.

COURSE OUTCOMES:

On completion of PT19 403 Strength of Material, the students will be able to

1. Demonstrate basic knowledge on principles of surveying, common building materials and methods of construction.
2. Apply theory of elasticity including strain/displacement and Hooke's law relationships.
3. Determine shear force, bending moment, stresses and deflection in beams for basic types of loading.
4. Calculate torsional stress in solid and hollow circular shafts.
5. Calculate critical load and stress during column buckling.

TEXT BOOK:

1. Rattan, Strength of Materials, 2e McGraw Hill Education India, 2011
2. Mechanics of Materials, R C Hibbeler, Prentice Hall Publication.
3. R. K. Bansal, Mechanics of solids, Laxmi Publications, 2004

REFERENCE BOOK:

1. Timoshenko, Strength of Materials, Vol I and Vol II, CBS Publishers & Distributors, New Delhi.

2. S. Jose, Sudhi Mary Kurian, Mechanics of Solids, Pentagon, 2015
3. F. Beer, E. R. Johnston, J. T. DeWolf, Mechanics of Materials, Tata McGraw Hill, 2011
4. E. P. Popov, T. A. Balan, Engineering Mechanics of Solids, Pearson Education, 2012

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 404	PRINTING MATERIAL SCIENCE	L-T-P-C 4-0-0-4

PRE-REQUISITE: Concepts of Printing

COURSE OBJECTIVES:

- ✓ This paper gives a basic knowledge about the characteristics and importance of various Materials used in Printing & Printing allied industries.

SYLLABUS:

Module I: **(10 Hours)**

Printing Materials- Introduction. Colloids- Types of Colloidal Systems, characteristics and properties, Colloid materials and application in printing industry-Light sensitive coating dichromate colloids, Diazo compounds, photopolymers. Sensitivity of coating to light. Dye-sensitized photo polymerization, dark reaction, post exposure, safe lights, reciprocity law. Action of light sources on coatings, stabilities of coatings.

Module II : **(11 Hours)**

Polymers and their applications in Printing and Packaging: Addition polymers: Polyolifins, Polyvinyls, polystyrenes. Condensation polymers: Polyeters, Polymides, Phenolics, Gluptal urethane.. Synthetic rubbers: Buna-N, Butyls, Neoprene, Thiokal-applications in Printing. Photo Polymerization and Flexo-graphic plates: Solid photopolymer plates, Liquid photo-polymer plates. Rubber flexo-photoengravings: Photo polymer letter press plates.

Module III: **(9 Hours)**

Printing Inks-Concepts of ingredients in printing inks and Properties. Vehicles, Pigments, Additives in Printing Inks. Adhesives- ingredients of an adhesive, Types of adhesives. Colloids in Printing ink Industry-Gelatin, Gum arabic, Egg albumin, Cellulose gum, Casein glue, Fish glue. Dyes-classifications. Pigments-Types, Properties. Varnishes-Types, Constituents, Applications of Synthetic Varnishes. Lacquers- Constituents, Applications in printing Industry.

Module IV: **(10 Hours)**

Types of Paper and paper for different printing processes: Ground wood paper, coated and commercial paper, labels and packing papers, publishing papers, business and writing paper, twin wire formed paper. **Paper Boards:** Types- Solid bleached sulfate, coated unbleached board, recycled paper board, outside wax laminated paper board, corrugated board and other boards. Suitability of paper boards to various printing processes.

Module V: **(12 Hours)**

Plasticizors-Plastics: Types, Properties. Preparation and applications. Elastomers. Laminated plastics. Plastic substrates-Types-PE, PP, PVC, PET, PS, Polyester and Cellophane. Properties, Testing and suitability of plastics to various printing processes.

Metallic substrates-Types: Aluminum, Gold, Silver, Tin, Copper, lead, Nickel, Alloys of Aluminum, Stainless steel and other metals. Properties and their testing. Graining of lithoplates-purpose & methods. Physical and chemical properties and their use in printing technology. Etching of litho-plates. Hydrophobic and hydrophilic surfaces, water and ink interaction.

COURSE OUTCOME:

On completion of PT19 404 Printing Material Science, the students will be able to

1. Identify the basic knowledge about the characteristics and importance of various Materials used in Printing & Printing allied industries.
2. Familiarize the Polymers used in the printing industry.
3. Acquire the knowledge of the Printing ink and its constituents.
4. Asses the Papers and Boards used in Printing Industry.
5. Understand the plastic and metallic substances used in the printing industry.

TEXT BOOKS:

1. Nelson R Eldred, Chemistry for the Graphic arts, GATF, USA, 1992.
2. Prakash Shetty, Science and Technology of Printing Materials, MJP Publishers, Chennai, 2008.
3. Adams J.M, Faux,D.D and Rieber L.J, Printing Technology, Delmar Publishers, NewYork.
4. Heigh. M. Speir, Introduction in Printing Technology.

5. Bob Thomson, Printing Materials Science and Technology, PIRA
6. W.H. Bureau, “What the printer should know about the paper”, GATF

REFERENCE BOOK **:**

1. Hand book of Modern halftone photography, perfect graphic arts, USA
2. Jack Eggleston, Sensitometry for photographers, focal Press, London
3. Woddiff Thomas , JR.SPSE handbook of photographic science and engineering, John Wiley & Son
4. Puri B.R, Sharm L.R and Pathania M.S, Principals of Physical Chemistry, Vishal Publishing Co, Jalandhar, 2002.
5. Anthony Bristow, Advances in Printing Sciences and Technology, Vol. 24-J.
6. A.S. Porter.- Lithographic Press Work
7. Handbook of printing and production-Michael Bernard, John Peacock.
8. Heigh. M. Speir Introduction in Printing Technology
9. J.P. Casey, Pulp and paper chemistry and chemical technology.
10. R.J. McGill, “ Measurement and control in paper making”, Adam Hilger Ltd.
11. D.Venkateswaralu, Paper for printing and packaging. SS Graphics .
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(p) publishers 2000Edition

EVALUATION SCHEME**:**

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 405	ELECTRIC DRIVES AND CONTROL	L-T-P-C 3-1-0-3

***PRE-REQUISITE*:** Basics of Electrical Engineering

COURSE OBJECTIVES:

- To study the basic concepts of power electronics & power electronic converters.
- To study the different types of electric drives.

SYLLABUS:

Module I: (12 hours)

Power semiconductor devices: Structure & static characteristics of Silicon Controlled Rectifier (SCR) - structure of Power Transistor, Power MOSFET & IGBT – comparison.
Controlled rectifier: 1-phase full-wave controlled bridge rectifier with R load –expression for average output voltage. **Inverter:** 1-phase full bridge inverter with R load – 3-phase full bridge inverter with R load(180°) mode – waveforms of line voltages only.

Module II: (10 hours)

AC voltage controllers: 1-phase AC voltage controllers (full wave) with R load – waveforms of output voltage – expression for RMS output voltage. **Cycloconverter**: midpoint type & bridge type - 1-phase step-up & step-down – with R & RL loads – waveforms.

Module III: (8 hours)

DC choppers: step down chopper - step-up chopper - step up and down chopper – expression for average output voltage in terms of duty ratio – two-quadrant chopper – four-quadrant chopper

Module IV: (10 hours)

Electric drives: parts of electric drives – torque equation - components of load torque – four quadrant operation. **DC drives**: Different types of dc motors – separately excited, shunt, series and compound motors – basic equations – armature control & field control of separately excited dc motor – single phase fully controlled converter for dc drives (continuous conduction only).

Module V: **(10 hours)**

3-phase induction motor: Squirrel cage and wound rotor type – torque equation –speed-torque characteristics Speed control - stator voltage control – stator frequency control – stator voltage & frequency control - pole changing method – rotor resistance control – static rotor resistance control - slip-power recovery scheme – static Kramer drive – static Scherbius drive

COURSE OUTCOMES:

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

1. Understand the various switching devices.
2. Acquire the knowledge of different types of power electronic converters
3. Identify the various choppers.
4. Explain the various DC & AC drives
5. Acquire the knowledge of the different special electrical machine drives

TEXT BOOKS: -

1. P.S. Bimbhra, Power Electronics, Khanna Publishers
2. Dubey G.K., Fundamentals of Electrical Drives, Narosa Publishing House
3. L. Umanand, Power Electronics – Essentials & Applications, Wiley-India
4. Mohan, Undeland, Robbins, Power Electronics, Converters, Applications & Design,Wiley-India

REFERENCE BOOKS: -

1. Vedam Subrahmanyam, Electric Drives – Concepts & Applications, Tata McGraw Hill Education
2. Muhammad H. Rashid, Power Electronics Circuits, Devices and Applications, Pearson Education
3. Alok Jain, Power Electronics: Devices, Circuits and Matlab Simulations,
4. Penram International Publishing (India) Pvt. Ltd.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

EN19 406	CONSTITUTION OF INDIA	L-T-P-C 2-0-2-0

***PRE-REQUISITE*:** Nil

***COURSE OBJECTIVES*:**

- To help the students to concentrate on their day to day discipline.
- To gives the knowledge and strength to face the society and people.

SYLLABUS:

Module I **(8 hours)**

Definition of constitution, historical back ground, salient features of the constitution - Preamble of the constitution, union and its territory - Meaning of citizenship, types, termination of citizenship.

Module II **(12 hours)**

Definition of state, fundamental rights, general nature, classification, right to equality, right to freedom, right against exploitation - Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences - Directive principles of state policy, classification of directives, fundamental duties.

Module III **(10 hours)**

The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions - The parliament, composition, Rajya sabha, Lok sabha, qualification and disqualification of membership, functions of parliament - Union judiciary, the supreme court, jurisdiction, appeal by special leave.

Module IV **(9 hours)**

The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories - The State Legislature, composition, qualification and disqualification of membership, functions - The state judiciary, the high court, jurisdiction, writs jurisdiction.

Module V **(9 hours)**

T Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission - Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals - Official language, elections, special provisions relating to certain classes, amendment of the Constitution.

COURSE OUTCOMES:

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

1. Explain the background of the present constitution of India and features.
2. Utilize the fundamental rights and duties.
3. Understand the working of the union executive, parliament and judiciary.
4. Understand the working of the state executive, legislature and judiciary.
5. Utilize the special provisions and statutory institutions.

***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. Ministry of law and justice, the constitution of India, Govt of India, New Delhi, 2019.
2. JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019
3. MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-100)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

PT19 407(P)	PRINT PRODUCTION LAB	L-T-P-C 0-0-3-1

10% - Attendance and Regularity in the class.

***PRE-REQUISITE*:** Nil

COURSE OBJECTIVES:

To develop a practical knowledge in Sheet fed and web offset machine.

SYLLABUS:

List of Experiments

(A minimum of 8 experiments must be conducted)

1. Familiarization of printing equipment's, conventional methods of printing.
2. Understanding different chemicals for offset printing process.
3. Process color printing in offset machine.
4. Setting the feeder board, lays and delivery of sheet fed offset machine.
5. Mounting of plate and blanket.
6. Setting of inking system.
7. Setting of dampening system.
8. Roller and cylinder pressure setting.
9. Taking single color print from sheet fed offset machine.
10. Taking multi color print from sheet fed offset machine.
11. Preparation of imposition for web offset printing and newspaper.
12. Study of pre-make ready &make-ready operations of web offset machine.
13. To obtain single color print from web offset machine.
14. To obtain multi color print from web offset machine.

COURSE OUTCOMES:

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

1. Identify the process colors and its combinations used in Printing.
2. Identify and Handle the infeed unit of the Sheet fed machine.
3. Manage the Inking and dampening system of the Printing Machine.

4. Take printout of a single-color copy.
5. Handle the Web-Offset machine

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern **(Maximum Marks-100)**

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

20% - Viva

10% - Fair record

PT19 408(P)	MACHINE DRAWING LAB	L-T-P-C 0-0-3-1

PRE-REQUISITE: Engineering Graphics

COURSE OBJECTIVES:

- This section helps the students to practice part drawings, production drawing, assembly drawing and line drawing of printing machines.

SYLLABUS:

List of Drawings

(A minimum of 8 Drawing sheet must be completed)

Module-1 Introduction to Fasteners:-

a. Screwed fasteners, Bolts and foundation Bolts.

b. Welded joints

c. Rivets & riveted joints.

Module-II Introduction to power transmission systems:-

a. Couplings

b. Pulleys

c. Keys

d. Gears:- Terminology , Types

e. Bearings:- Journal, Roller

Module-III Assembly Drawings

a. Lathe Parts: - Tail Stock, Tool Post, and Carriage.

b. Valves – Stop valves, Safety valves

c. Miscellaneous Machine Elements- C-clamp, Bench-vice, Screw jack, Machine vice

d. Introduction to Surface, Texture, Limit, Fit, Tolerance.

Module-IV Drawings of Printing Machines

a. Drawings of Operation process charts in Presses.

b. Simple exercises using Auto CAD

c. Line Drawing exercise of various machines

COURSE OUTCOMES:

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

1. Acquire the knowledge of various standards and specifications about standard machine components.
2. Familiarize the power transmission systems.
3. Make drawings of assemblies with the help of part drawings given.
4. Ability to select, configure and synthesize mechanical components into assemblies.
5. Draw machine parts using software.

TEXT BOOKS:

1. P.I.Vargheese, Machine Drawing, VIP Publishers, Thrissur.
2. K.C. John, Machine Drawing, Jet Publications, Thrissur.
3. N.D. Bhatt and Panchal, Machine Drawing, Charator Publishing House.

REFERENCE BOOKS:-

1. K.L.Narayana, P.Kannaiah & K. Venkata Reddy, Machine Drawing, New Age Publishers,2009
2. Gautam Pohit & Gautam Ghosh, Machine Drawing with AUTO CAD, Pearson Education, New Delhi.
3. N.D.Junnarkar, Machine Drawing, Pearson Education, New Delhi.

EVALUATION SCHEME

Internal Continuous Assessment **(Maximum Marks-50)**

60% - Drawing Sheet

30% -Test

10% - Regularity in the class

*__Exercises of Module-IV is considered only for Internal assessments__

University Examination Pattern **(Maximum Marks-100)**

Question I:

Answer any one question out of two questions of 25 marks each from (a) or
(b) or (c) section of module I.

1x25 marks= 25 marks

Question II:

Answer any one question out of two questions of 30 marks each from (a) or
(b) or (c) or (d) or (e) section of module II**.**

1x30 marks= 30 marks

Question III:

Answer any one question out of two questions of 45 marks each from (a) or
(b) or (c) or (d) section of module III.

1x45 marks= 45 marks

EN19 501	ENGINEERING ECONOMICS AND PRINCIPLES OF MANAGEMENT	L-T-P-C 3-1-0-3

SECTION 1: ENGINEERING ECONOMICS

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To make fundamentally strong base for decision making skills by applying the concepts of economics.
- Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
- Prepare engineering students to analyse profit/revenue data and carry out make economic analysis in the decision making process to justify or reject alternatives/projects.

SYLLABUS:

Module I: **(11 hours)**

Introduction to Engineering Economics – Technical efficiency, Economic efficiency.
Supply and Demand: Determinants of demand, Law of demand, Determinants of supply, Law of supply, Market equilibrium. Elasticity of demand – Types of elasticity, Factors affecting the price elasticity of demand - Utility analysis, indifference curves, Law of equi- marginal utility, marginal utility theory, Law of diminishing marginal utility -production possibility curve Production concepts-average product-marginal product-law of variable proportions, Isoquant.

Module II: **(10 hours)**

Value Analysis - Time value of money - Interest formulae and their applications: Single-payment compound amount factor, Single-payment present worth factor, Equal-payment series compound amount factor, Equal-payment series sinking fund factor, Equal-payment series present worth factor, Equal-payment series capital recovery factor, Effective interest rate. Investment criteria: Pay Back Period, Net Present Value, Internal Rate of Return, Benefit-cost ratio.

COURSE OUTCOMES:

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

- Analyse the basic concepts used in engineering economics and apply the basics of economics to take economically sound decisions.
- Understand Time Value of Money and apply suitable cash flow methods for different situations.

TEXT BOOKS:

1. Panneerselvam. R, Engineering Economics, Prentice Hall of India Ltd, 2001.
2. Dwivedi, D.N., "Managerial Economics, 7/E", Vikas Publishing House, 2009.
3. Salvatore D. Managerial Economics: Principles and Worldwide Application: (adapted version). OUP Catalogue, 2012.

***REFERENCE BOOKS*:**

1. Sullivan, W.G, Wicks, M.W., Koelling. C.P., Engineering Economy 15/E, Prentice Hall, New York, 2011.
2. Chan S. Park, Contemporary Engineering Economics‖, Prentice Hall of India, 2002.
3. Prasanna Chandra, Financial Management: Theory & Practice, 8/E, Tata-McGraw Hill, 2011.
4. Rangarajan C. Indian economy: essays on money and finance. UBS Publishers' Distributors; 1999.

Internal Continuous Assessment ***(Maximum Marks-20)***

70% - Tests (minimum 2)

20% - 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-40)***

PART A: Analytical/problem solving SHORT questions ***4 x 5 marks= 20 marks***

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

PART B: Analytical/Problem solving DESCRIPTIVE questions

2x10marks=20 marks

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

SECTION 2: PRINCIPLES OF MANAGEMENT

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To develop ability to analyse and evaluate a management processes and variety of management practices in the contemporary context;
- To understand and apply the basic concepts of functional areas of management like Human resources, Marketing and Finance;
- To be able to evaluate managerial decision making process, project management techniques, developing innovative products and social responsibility ideologies to create sustainable organisations;
- To be able to understand existing managerial practices to create their own innovative management competencies, required for complex global workplace.

SYLLABUS:

Module III: **(10 hours)**

The management process: managerial skills and roles, evolution of management theory; principles of planning: types of plans, steps in planning; principles of organizing: organizational structures; directing; motivation; controlling; sustainability in management.

Module IV: **(11 hours)**

Human resource management: human resource planning, performance metrics.
Marketing management: fundamentals of marketing, market segmentation, consumer and industrial markets.
Financial management: Basic principles of: double entry book keeping, financial statements, sources of finance, classification of costs, break-even analysis (Basic concepts only).

Module V: **(10 hours)**

Managerial decision making process: decision making under certainty, risk and uncertainty; network techniques for project management: critical path method (CPM); Programme Evaluation and Review Technique (PERT): time/cost trade-off in critical path networks (simple problems only).
Entrepreneurial processes: analysis of new ventures/start-ups, creating innovative products/services and business plans, importance of corporate social responsibility

COURSE OUTCOMES:

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

- List out the roles, skills and functions of management.
- Analyse the basic concept of human resources, marketing and financial management in the organizations and integrate the learning in handling these complexities.
- Apply the concept of decision making, network techniques, analysis of new ventures as a part of project management / an organization.

TEXT BOOKS:

1. H. Koontz, and H. Weihrich, Essentials of Management: An International Perspective, 10^{th} Edition. McGraw-Hill, 2015.
2. Ramesh Unnikrishnan, Principles of Management, Educational Publishers and Distributers, 2021.
3. O. P. Khanna, Industrial Engineering and Management, 17^{th} Edition, Dhanpat Rai Publications, 2018.

***REFERENCE BOOKS*:**

1. R. W. Griffin, Management: Principles and Applications. 10^{th} Edition, Cengage Learning, 2008.
2. P. Kotler, K. L. Keller, A. Koshy, and M. Jha, Marketing Management: A South Asian Perspective, 15th ed. Pearson, 2014.
3. M. Y. Khan, and P. K. Jain, Financial Management. 8^{th} Edition Tata-McGraw Hill, 2018.
4. Heinz Weirich, Mark V Cannice and Harold Koontz, Management: a Global,

Innovative and Entrepreneurial Perspective, 14th Edition, McGraw Hill Education, 2013.

Internal Continuous Assessment **(Maximum Marks-30)**

70% - Tests (minimum 2)

20% - 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-60)**

PART A: Analytical/problem solving SHORT questions ***6 x 5 marks= 30 marks***

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

PART B: Analytical/Problem solving DESCRIPTIVE questions ***3x10marks=30marks***

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

Note: Section 1 and Section 2 are to be answered in separate answer books.

Maximum 40 marks and 60 marks for Section 1 and Section 2 respectively.

PT19 502	PACKAGING TECHNOLOGY	L-T-P-C 4-0-0-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- The technology used for creating good packages according to the product.
- Deals about important packaging materials.
- To study the different types of packaging process and package testing methods.

SYLLABUS:

Module I **(10Hours)**

Introduction, Function of a package, Factors influencing design of a package, Computer, Aided, Package Design, Packaging Cycle, Product Package Relationship, Elements of Package Design, Classification of Packaging – Flexible package type, Rigid package types. Hazards on package – Mechanical, Climatic, Biological and other hazards. Markings on package – Handling marks, routing marks, information marks.

Module II **(11Hours)**

Tests on Package – Mechanical test –Climatic test –, Fungus resistance test, Shelf life, Corrosion – Types, cause, Classification of corrosion prevention methods.Desiccants. Cushioning Materials – Functions, properties, Classifications. Expanded polystryrene – process of manufacturing, advantages, applications. Carton style, Folding cartons – Production steps, types. Corrugated containers – classifications, components in a corrugated board, flutes, stages in preparation in corrugated boards.

Module III **(11Hours)**

Gas packaging – MAP & CAP, Vaccum packaging, shrink packaging, stretch wrapping blister packaging, skin packaging, strip packaging, Aerosal packaging – working principle. Vaccum metalization, Injection blow moulding, Extrussion blow moulding, Extrusion. Injection Molding, Vaccum forming – Drape forming, Snap back forming, Plug Assist forming. Pressure forming. .

Thermo form/fill/seal- Horizontal machine, Vertical machine.

Module IV **(10 Hours)**

Wood- classification, effect of moisture on wood, preservation of wood, advantages. Board-types, paper types Glass- properties, advantages, types, production process of glass, Plastics-BOPP.HDPE, LDPE, LLDPE, PVC, PP, PET, Polyolefins, Cellulosics, Polymides, Nylon-6 – advantages, functions & applications. Tests on plastics, process of making plastic sheets. Classifications of plastics. Aluminium foils – Manufacturing of foil, properties, applications.

Module V **(10 Hours)**

Designing –Cans, metal tubes, Plastic tubes. Closures-screw caps, Snap-on caps. Adhesive tapes – Fabric tapes, Paper tapes, Film tapes, Foil tapes, Foam tapes, Two faced tapes.

Labels – Basic elements of correct labelling, Purpose, types. Futuristic trends in packaging. Advancements in food packaging. Environmental implications of packaging – recycling, Pyrolysis. Legal aspects in packaging.

COURSE OUTCOMES:

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

1. Know about types of packages and manufacturing processes.
2. Comprehend the importance of package design for various applications.
3. Analyze various test methods for package suitability.
4. Create the design of primary, secondary and tertiary packaging.
5. Know about types of packaging materials.

TEXT BOOKS

1. Packaging Technology – Volume I - IIP
2. Packaging Technology – Volume II - IIP
3. Packaging Technology – Volume III – IIP
4. Brody Aaron L., The Wiley Encyclopaedia of Packaging Technology, John Wiley & Sons, Inc. 1997.
5. Richard Gendron, Thermoplastic Foam Processing - Principles and Development, CRC Press, 2005.
6. Athalye A.S., Plastics in Packaging, Tata McGraw-Hill, 1992.

7. Briston John., Advances in Plastic Packaging Technology, PIRA, 1992.
8. Natarajan S, Fundamentals of packaging technology, *PHI*, 2009.

REFERENCE BOOKS:

1. Joseph Kerry & Paul Butler, Smart Packaging Technologies for Fast Moving Consumer goods, John Wiley & Sons, Ltd, 2008.
2. Brody Aaron L, The Wiley Encyclopedia of Packaging Technology, John Wiley & Sons, Inc., 1997.
3. Hanlon Joseph F, Handbook of Package Engineering, CRC Press, 1998.
4. Briston John, Advances in Plastic Packaging Technology, PIRA, 1992.
5. Natarajan S, Fundamentals of packaging technology, PHI, 2009.
6. Frank Paine,Packaging design and performance.
7. John Briston., Advance in Plastic Packaging Technology.

EVALUATION SCHEME:

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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* ***5x10marks=50marks

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

PT19 503	MICROPROCESSOR AND MICROCONTROLLER	L-T-P-C 3-1-0-3

PRE-REQUISITE: Basics of Electronics Engineering

COURSE OBJECTIVES:

- To familiarize the architecture of 8086 processor,
- To understand 8051 Microcontroller concepts, architecture, programming and application of Microcontrollers.
- To familiarize assembling language programming and interfacing with various modules.
- To provide the knowledge about Application of Microcontroller and Microprocessor in Printing Industry.

SYLLABUS:

Module I **(10 Hours)**

Brief history of Microprocessors, Intel 8086 processor- Internal Architecture of 8086 microprocessors- Bus Interface Unit (BIU) and Execution Unit (EU), Memory Segmentation, Memory and Data Organization.

Module II **(13 Hours)**

Hardware Architecture of 8086 -Minimum and Maximum mode of operation-Basic read and write machine cycle, DMA, Concept of Multiprocessor configuration.

Programming concepts: Addressing Modes of 8086, Instruction set - Data transfer- Arithmetic, Logic and branching shift and rotate operations, Basic Assembly programming using instructions for data transfer, arithmetic and logical operations.

Module III **(11 Hours)**

Basic interfacing concepts: Memory and I/O interfacing -Hand shaking, Serial and Parallel interfacing. Memory devices, various types of memories,

Interrupts: 8086 Interrupt –Implementation of the 8086 interrupts, Programmable interrupt controller (8259).

Module IV **(10 Hours)**

Microcontrollers: Introduction, comparison between microprocessors and microcontrollers, Introduction to microcontroller families (PIC,AVR,ARM).

8051 Microcontroller - Features, Architecture, Pin configuration, Memory organization, Registers, I/O ports, Timers & Counters, Interrupts, Data transmission, Data reception.

Module V **(8 Hours)**

Assembly language programming examples for 8051

Unsigned addition, Subtraction, Multiplication and Division, Interfacing of DIP switch , LEDs, 7 segment displays and stepper motor

Application of Microcontroller and Microprocessor in Printing Industry.

COURSE OUTCOMES:

The student will be able to

1. Acquire the knowledge of the internal architecture and memory organization of and assembly language programming of 8086 processor.
2. Understands the internal architecture, organization and assembly language programming of 8051 microcontroller.
3. Explain the interfacing concepts of 8086 and 8051 based systems.
4. Know about Application of Microcontroller and Microprocessor in Printing Industry
5. Develop systems using different microcontrollers.

TEXT BOOKS:

1. Sunil Mathur, Microprocessor 8086: Architecture, Programming and Interfacing, PHIL earning Pvt. Ltd.
2. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems Using Assembly and C”, 2nd edition, Pearson Education India, 2008
3. Douglas V.Hall, “ Microprocessors and Interfacing “ Tata McGraw Hill International, Delhi, revised 2nd ed.,2005

REFERENCE BOOKS:

1. Kennth J Ayala, 8086 Microprocessor: Programming and Interfacing the PC, West Pub.,1995
2. Kenneth J. Ayala, The 8051 Microcontroller 3E, 3rd edition, Cengage Learning, 2004

EVALUATION SCHEME:

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - 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 ***5x10marks=50marks***

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

PT19 504	FLEXOGRAPHY	L-T-P-C 4-0-0-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To learn the basic principles of flexographic printing.
- To understand the various Flexographic plate preparation methods.
- To learn the mounting and proofing methods.
- To comprehend the parts of flexography press and its operation.

SYLLABUS:

Module I **(10 Hours)**

Definition of Flexography, Flexographic products, Advantages of Flexography. Mechanical principles of flexography – Fountain roll, Anilox roll – doctor blade with two roll system, blade and ink applicator, enclosed or manifold inking system. Plate cylinder, Impression cylinder. Basic elements of Flexography – Print plate, Cylinders - integral, demountable, sleeves, magnetic. Gears. Mounting & proofing devices, Flexographic printing press – unwind and in feed section, printing section, drying section, out feed and rewind section. Sheet fed flexo presses. Inks, Variations in flexo presses - impression bar, reverse angle doctor blade. The flexo press as a coater.

Module II **(12 Hours)**

Flexographic printing plates – Molded rubber plates – basics of rubber plate making, rubber printing plate compounds, rubber plate molding. Molded printing plate manufacture – molding press, thickness control bearers, bench micrometers, rubber plate finishing. Making the thermosetting mold or matrix – composition of matrix, shrinkage and its control, matrix floor, determining thickness control bearers, preheat function, position molding, pressure and curing requirements, matrix mold make ready, procedure for molding a matrix. Types of molded printing plates. Photo polymer plates – Basics of photopolymer plates. Types of Photopolymers – Plate making from liquid photo polymer, plate making from sheet photo polymer. Auxiliary equipment needed to produce printing plate. Design rolls – laser engraved design rolls. Plates for process printing, Care and handling of printing plates.

Module III **(8 Hours)**

Flexo press types – Stack press, Central impression cylinder press, Inline press. Tension in flexographic m/c, Tension zones, tension levels and pattern for zones, Web tension control systems. Unwind equipment – general, single-position unwind – flying-splice unwind, unwind tension systems, in feed unit, cooling drum or out feed unit. Rewind equipment – surface winders, center winders, rewind tension systems. Web guides. Printing stations – two roll, anilox roll, reverse angle doctor blade system, Deck control, Continuous inking, side and circumferential register control, Dryers.

Module IV **(12 Hours)**

Mechanical components – CI drum, Plate cylinders. Anilox roll – construction, cell structure, anilox roll wear, selecting the right anilox roll, chrome plating. Fountain rolls – formulating rubber for rolls, Flexo roll coverings, properties of rubber, care of covered rolls. Cooling rolls. Balancing flexo rolls. Deflection of rolls. Repeat lengths increments – Direct drive quadrant geared press.
Mounting and Proofing. Purpose of mounting and proofing. Checking the equipment. Operator care of equipment. Understanding the mounting instructions. Mounting and proofing a complete line job. Computerized mounting and proofing system. Pin register mounting system, Plate mounting without a mounting & proofing equipment.

Module V **(10 Hours)**

Miscellaneous procedures – removing plates from the cylinder, mounting metal-backed plates, reusing sticky back, plate staggering, use of release agents. .Tools for the operator. Press room practices. Environment and safety concerns. Flexo graphic substrates. Narrow web presses – Narrow web press components, Future narrow web flexography. Wide web presses. Basic requirements for process color printing. Corrugated presses. Preprinted linear presses. Future of Ink distribution system. Tomorrow's flexographic plates. News print for water-base flexography. Markets for today and tomorrow.

COURSE OUTCOMES:

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

1. State the factors influencing design for flexography.

2. Design and optimize the plate preparation process
3. Explain the steps in the image carrier preparation and mounting
4. Discuss about the working of flexographic press and its control.
5. Implement quality control in flexographic printing workflow.

TEXT BOOKS:

1. Flexography: Principles & Practices, 6th Edition, Foundation of Flexographic Technical Association, 2014.
2. FIRST: Flexographic Image Reproduction Specifications &Tolerances 5.0, 5th Edition, Foundation of Flexographic Technical Association, 2014.

REFERENCES:

1. Anthony White, High Quality Flexography, Pira reviews of Printing, Pira International,1999.
2. Frederick R. Boyle, The Flexo Environment, Foundation of Flexographic Technical Association, 2002.
3. Helmut Kipphan, Handbook of Print Media, Springer-Verlag, 2001

EVALUATION SCHEME:

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)
20% - 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= 50marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PT19 505	MACHINE DYNAMICS	L-T-P-C 3-1-0-3

PART B: Analytical/Problem solving DESCRIPTIV questions ***5x10marks=50marks***

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

PRE-REQUISITE: Basics of Mechanical Engineering

COURSE OBJECTIVES:

- Provides the necessary foundation and establish the theory, analysis, design and practice of mechanism and kinematics & dynamics of machines.
- To provide fundamental knowledge in the design of common machine elements like gears, shaft, springs and bearings.

SYLLABUS:

Module I **(10 Hours)**

Introduction to kinetics and mechanism, Kinematic pair, Kinematic Chain and inversions. Constrained and unconstrained motion. Four bar mechanisms. Single and double slider crank mechanisms with inversions, quick return mechanism.

Classification of cams and followers –displacement diagrams, velocity and acceleration analysis of SHM uniform velocity, uniform acceleration, cycloidal motion

Module II **(10 Hours)**

Static and dynamic balancing. Balancing of several masses rotating on same plane. Balancing of several masses rotating on different planes. Balancing of reciprocating masses. Primary and secondary unbalanced forces in reciprocating masses. Partial balancing of unbalanced force in reciprocating engine

Vibration –types, Un-damped and damped (Viscous damping only). Logarithmic decrement. Forced damped vibrations. Vibration isolation and transmissibility.

Module III **(11 Hours)**

Introduction to gear drives, classification of gears, gear materials, Law of gearing, Forms of teeth involute, cycloidal Determination of length of path of contact. Arc of contact. Contact ratio. Interference in involute gear. Minimum number of teeth on pinion to avoid interference, types of gear trains. Force analysis in spur gear, helical gear, bevel gear and worm gear

Introduction belt drive, open and crossed belt drive, condition for max power transmission, slip in belt drive.

Module IV **(11 Hours)**

Steps in design, Standards and codes in design. Materials and properties, endurance limit stress, factors effecting endurance limit, factor of safety

Sliding contact bearings lubrication, lubricants viscosity journal bearings hydrodynamic theory, Somerfield number, design consideration, heat balance. Rolling contact bearings, bearing life static and dynamic loads, selection of rolling contact bearings, dynamically equivalent load.

Module V **(10 Hours)**

Design considerations of shaft, causes of failure in shafts, Design of shaft based on strength, and rigidity. Design of couplings rigid and flexible couplings. Design of keys and pins.

Springs-classification-spring materials – stress and deflection of helical springs axial loading curvature effect, resilience, static and fatigue loading surging, critical frequency.

COURSE OUTCOMES:

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

1. Summarize the kinematic elements and inversions of various planar mechanisms.
2. Analyze the concept and procedure for balancing of rotating and reciprocating masses.
3. Develop a better understanding on classification of gears and to perform the force analysis in spur, helical, bevel and worm gear.
4. Select suitable sliding and rolling contact bearings for a given condition of loading.
5. Determine the optimum diameter of shaft by applying various theories of failures for given condition of loading.

TEXT BOOKS:

1. K Raghavendra, Design of Machine Elements, Volume I and II, CBS Publishers & Distributors Pvt.Ltd.

2. T Krishna Rao Volume I and II, I K International Publishing House Pvt.Ltd
3. S. S. Rattan, Theory of Machines, Tata Mc Graw Hill,2009
4. Ballaney P. L., Theory of Machines and Mechanisms, Khanna Publishers,2005
5. V.B. Bhandari, Design of Machine elements, McGraw Hill, 2010

Data books permitted for reference in the final examination:

1. Narayana Iyengar B.R & Lingaiah K, Machine Design Data Handbook, Tata McGraw Hill/Suma Publications, 1984
2. K. Mahadevan, K.Balaveera Reddy, Design Data Hand Book, CBS Publishers & Distributors, 2013
3. PSG Design Data, DPV Printers, Coimbatore, 2012

REFERENCE BOOK:

1. Ghosh, A. K. Malik, Theory of Mechanisms and Machines, Affiliated East West Press,1988
2. C. E. Wilson, P. Sadler, Kinematics and Dynamics of Machinery, Pearson Education,2005
3. J. E. Shigley, J. J. Uicker, Theory of Machines and Mechanisms, McGraw Hill,2010
4. R. L. Norton, Machine Design – An Integrated Approach, Pearson Education, 2001
5. Juvinall R.C & Marshek K.M., Fundamentals of Machine Component Design, John Wiley,2003

EVALUATION SCHEME:

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - 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***

PT19 506(A)	INDUSTRIAL PSYCHOLOGY	L-T-P-C 3-1-0-3

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

5x10marks=50marks

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

PREREQUISITE: Nil

COURSE OBJECTIVES:

- Helps to build job related skills and also helps to improve work performance in an organization.
- To learn about theories of motivation and group behavior.
- To understand the socio-cultural aspects in organizations

SYLLABUS:

Module I **(10 Hours)**

Introduction - psychology as a science - areas of applications - study of individual - individual differences - study of behaviour - stimulus - response behaviour - heredity and environment - human mind - cognition - character - thinking - attention - memory- emotion - traits - attitude – personality

Module II **(10 Hours)**

Organizational behaviour - definition - development - fundamental concept - nature of people - nature of organization - an organizational behaviour system - models - autocratic model - hybrid model - understanding a social - system social culture - managing communication - downward, upward and other forms of communication

Module III **(11 Hours)**

Motivation - motivation driver - human needs - behaviour modification - goal setting - expectancy model - comparison models - interpreting motivational models - leadership - path goal model - style - contingency approach

Module IV **(11Hours)**

Special topics in industrial psychology - managing group in organization - group and inter group dynamics -managing change and organizational development - nature planned change - resistance - characteristic of OD - OD process.

Module V **(10 Hours)**

Labour Relations and Employee Security: Promotion transfers and separations, wages and salaries administration, discipline and grievances, industrial and labour relations, trade unionism, collective bargaining, and industrial health. Employment, Induction & Socialization: Placement policy, induction programs, and socialization programmes.

COURSE OUTCOMES:

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

1. Improve work performance in an organization.
2. Know about theories of motivation and group behavior.
3. Understand the socio-cultural aspects in organizations.
4. Acquire the knowledge about labour relations and Employee security.
5. Know about importance of motivation in industry.

TEXT BOOKS:

1. T.V. Rao and Pereira D F, Recent experiences in Human Resources Development, Oxford and IBH Publishing, 1986.
2. Subbrao A., Essentials of Human Resource Management and industrial Relations, Himalaya Publishing House, 1999.
3. N G Nair and Latha Nair, Personnel Management and Industrial Relations, S. Chand Company, 1995.
4. Virmani B R, Rao Kala, Economic restructuring technology transfer and human resource development, Response books, 1997.
5. Pareek Udai et al., Human Resource Development in Asia: Trends and Challenges, Oxford and IBH Publishing, 2002.

6. Michael Armstrong., A handbook of Human Resource Management Practice, Kogan Page limited.
7. Gary Dessler & Biju Varkkey, Human Resource Management, Pearson education, 2011.

REFERENCE BOOKS:

1. Davis K. & Newstrom J.W., "Human Behavior At Work", McGraw Hill International
2. Schermerhorn J.R. Jr., Hunt J.G. & Osborn R.N., "Managing Organizational Behavior",
3. John Willy Luthans, "Organizational Behavior", McGraw Hill, International
4. Morgan C.T., King R.A., John Rweisz & John Schoples, "Introduction to Psychology", McGraw Hill
5. Blum M.L. & Naylor J.C., Horper & Row, "Industrial Psychology", CBS Publisher.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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 ***5x10marks=50marks***

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

PT19 506(B)	MECHANICS OF PRINTING	L-T-P-C 3-1-0-3

PRE-REQUISITE: Offset Technology

COURSE OBJECTIVES:

- To be acquainted with the mechanical aspects of printing**.**

SYLLABUS:

Module I **(10 Hours)**

Typical lithographic press design-Printing cylinders, Inking System-Dampening System-Three important phenomena-wetting-Ink contact angle-wet by ink, wet by fountain, surface tension-young's equation-emulsification-NIP action-Theory behind the lithographic press, cylinder design-required printing pressures-for gravure, offset lithography.

Module II **(10 Hours)**

Rollers and rolling action-roller design properties-Mechanical construction, dead shaft roller design, live shaft roller design-ink receptive roller material-water receptive roller material, complaint rollers-rigid material-surface specification of rigid rollers and compliant rollers, Relation connecting surface speed (V) width of stripe(S).

Module III **(11 Hours)**

Inking system design-inking rollers- Macphec's design requirements-over shot orientation-under shot, Types of metering elements-continuous blade-segmented blade, discrete elements-discrete elements with cover-ductor mechanism-dynamic behavior of inking system-long term and short term behavior, Relationship between print density and ink feed rate, heat generation in inking system- heat generation due to film slitting (Qfs)-due to vibration action (Qva) due to slippage due to cyclic straining(Qcs).

Module IV **(10 Hours)**

Web presses – categorization of web press- heat set –non heat set- web guides- web tension-role of capstan roller-capstan equation for controlling web tension –wrap angle- relationship between velocity and tension of web.

Module V **(11 Hours)**

Fundamental elements of offset printing machine. Sheet feeding requirements. Types of feeders, sheet controls, drives, suction head mechanism, double sheet and no sheet detectors, side lays and front lays. Non-stop feeders. Sheet insertion and transfer systems, working principle, relative merits.

COURSE OUTCOMES:

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

1. Describe typical lithographic press design.
2. Explain the sheet feeding mechanism.
3. Select the appropriate rollers for printing and rolling actions.
4. Define the Inking system and designs.
5. Know about web presses.

TEXT BOOKS:

1. John Macphee, GATF Press, Fundamentals of lithography printing, Volume I Mechanics of printing.
2. Helmutt Kipphan, Handbook of Print Media, Springer, Heidelberg, 2001
3. Lloyd P. Dejidas, Thomas M. Destree, Sheetfed Offset Press Operating, GATF, 2005.

REFERENCES:

1. A.S.Porter, A Manual of Lithographic Press Operation, Lithographic Training Services, 1977
2. John MacPhee, Fundamentals of Lithographic Printing: Vol.I - Mechanics of Printing, GATF, 1998.
3. Thomas M. Destree, The PIA/GATF Guide to Troubleshooting for the Sheetfed Offset Press, GATF, 2005
4. W.R.Durrant. R.E. Witeworth and C.W.Meacock, Machine Printing, Focal Press, London, 1973

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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* ***10x5marks= 50marks***

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*

5x10marks=50marks

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

PT19 506(C)	COMPUTER GRAPHICS	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- Develop theoretical knowledge about computer graphics and its principles.

SYLLABUS:

Module I **(11 Hours)**

Introduction, The origin of computer graphics, working of interactive-graphics display, New display devices, General purpose graphics software, The user interface, display of solid objects, A line drawing displays-Display devices and controllers, Display devices, The CRT-electron guns, Deflection system, phosphors, Beam penetration CRT, shadow mask CRT. Inherent-memory, devices-Direct view storage tube, plasma panel, laser-scan display, the storage tube display, The refresh line-drawing display. Two dimensional transformations, transformation principles, concatenation, matrics representation-matrics formulation of transformations, concatenation of matrics transformations efficiency. The chipping and windowing-a line chipping algorithm, midpoint sub divisions, clipping other graphic entites, polygon clipping, viewing transformations, the windowing transformations.

Module II **(10 Hours)**

Three-dimensional graphics-realism in three dimensional graphics-molecular modeling, CAD, animation, simulation, Techniques for achieving realism-parallel projections, perspective projections, intensity curves, stereo scopic views, Kinetic depth effects, hidden-line elimination, shading with hidden surfaces removed,3D images. Modelling three dimensional scenes-cordinate system, modeling objects, cube representation, representing topology & geometry, structured three dimensional models, constructing models, Modelling & realism.

Module III **(10 Hours)**

Illumination models- ambient light, diffuse reflection, atmospheric attenuation, specular reflection, improving the point light source model, multiple light sources. Shading models for polygons-constant shading, interpolated shading, polygon mesh shading, gouraud shading, phong shading, problems with interpolated shading. Surface detail-surface detail polygons texture mapping, bump mapping, other approaches, shadow-scan-line generation of shadow, a two pass object-precision shadow algorithm, shadow volumes, a two-pass-z buffer shadow algorithm, global illumination shadow algorithms.

Module IV **(11 Hours)**

Transparency- non refractive transparency, refractive transparency, inter object reflecting, Physically based illumination models-improving the surface model, the microfacet distribution function, the geometrical attenuation factor, the fresnet term. Extended light sources, spectral sampling, improving the camera model, global illumination algorithms, recursive ray tracing-efficiency considerations for recursive ray tracing-a better illumination model, Area sampling variations, distributed ray tracing, ray tracing from the light source. Radosity methods-radosity equations, computing form factors, sub structuring, progressive refinement. computing more accurate form factors, specular reflection, combining radosity and ray tracing.

Module V **(10 Hours)**

Rendering pipelines-local illumination pipelines, global illumination pipelines, designing flexible renders, progressive refinement. Summery, Animation-conventional animation, computer assistance animation, interpolation, simple animation effects, animation languages-Linear-list notation-full explicit control, procedural control, constraint based system, tracking live action, actors, kinematics and dynamics, physically based animation. Basic rules of animation. problems peculiar to animation summary.

***COURSE OUTCOMES*:**

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

1. Describe computer graphics and its principles.
2. Know about Transparency and its advantages.
3. Apply the Three-dimensional graphics and molecular modelling in graphics.
4. Demonstrate the illumination models.
5. Explain the basic of animation and rendering pipelines.

TEXT BOOKS:

1. Computer graphics principles and practice 2nd Ed.-Van Dam, Fole, Fiener Hughes.

2. Principles of interactive computer graphics, 2nd Ed, William N Newman, Rober T Sproull.

REFERENCE BOOKS:

1. Computer graphics-Heam &Backer.
2. Procedural elements of computer graphics-David F .Rogers.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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.

PT19 506(D)	DESIGNING & PLANNING FOR MEDIA PRODUCTION	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To develop the concept of design in print media and gives knowledge about the planning methods in media production.

SYLLABUS:

Module I **(10 Hours)**

Characteristics of vision. Human interpretation of movement, colour pattern. Psychological influences of consistency. Language as a communication tool-terminologies meaning of metaphor, simile, synecdoche, allegory etc., examples denotation, connotation. Relationship between design of a communication and sale of a product. Graphic designer and his role. Elements of design. Principles in designing.

Module II **(11 Hours)**

Visual ingredients of graphic design, point, line, graphic space, texture, colour, scale, balance and contrast. Use of computers in designing. Introduction to some designing softwares. Suitability for a particular job, design, printing technique and paper surface. Legibility and readability, monograms and trademarks. The relationship between type, illustration and Photography. Types of images. Photography as a design element preparation, selection and assessment of originals, photographs, sketches, paintings. Factors to be considered in photography.

Module III **(11 Hours)**

Control and checking of art work at all stages, employment of free-lance artists, designers and photographers. The advertising agency, its structure and its services. Methods of preparing a design in various stages. Design for books, magazines, newspapers, catalogues, cartons and commercial stationary. Materials and tools used in preparing layouts and art work. Copy preparation. Casting-off and marking up. Identifying requirements of the proposed print job and obtaining a clear brief. Explanation of a good brief. Writing a good brief. Relationship between designer, customer and printer.

Module IV **(10 Hours)**

Selection and co-ordination of production processes within the economic terms of the brief consideration of composition methods. Limitations of binding, finishing and ancillary processes as they affect design. Selection and specification of ink, paper and other materials in relation to design specifications and to the production process decided. Selection of colour. Hosting maintenance of website. Production of advertising commercials, corporate and industrial films.

Module V **(10 Hours)**

Designing of a website. Factors to be considered. Importance of a site map. Content creation. Co-ordination of work between various departments. Job flow and co-ordination between various agencies. Meaning of a scratch, story board and final presentation. Production for radio jingles-factors to be considered. Work flow and final execution. Analysis of production problems. Understanding estimating procedures. Technical influences of choice of process and materials available.

COURSE OUTCOMES:

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

1. Explain the concept of designs in media.
2. Acquire knowledge about factors affecting designing.
3. Acquire about the principles of designing.
4. Demonstrate website designing maintenance.
5. Define, discuss and develop critical writings on designing concepts of books, magazine, catalogs etc.

TEXT BOOKS:

1. Sohick (Cd)- Fundamentals of Copy & Layout- A.C. Book (Ac)
2. Craig- Production for the Graphic Designer
3. Muray (Ray)- How to brief designs & buy print
4. Leon O Chus & Pen Min Lin C.A.- Copy Preparation

REFERENCE BOOKS:

1. A.S. Porter - Lithographic Press Work
2. Rooney J. & Steadmazn P.- Principle of CAD

3. David A. Akar & John G. Myers.- Advertisement management
4. Arthur Robinson, Randall Sale & J.K. Morrison- Elements of Cartography.
5. Jal Baker. - Analysis of Electronic Circuit.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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.

PT19 506(E)	ENTREPRENEURSHIP MANAGEMENT	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Explaining the types, characteristics of entrepreneurship and its role in economic development.
- Applying the theories of achievement motivation and the principles of entrepreneurship development program to enterprise.
- Selecting the appropriate form of business ownership in setting up an enterprise.
- Applying the fundamental concepts of finance and accounting to enterprise.
- Identifying sickness in industry, selecting the appropriate corrective measures, and identifying the growth strategies in enterprise.

SYLLABUS:

Module I **(10Hours)**

Entrepreneur – Characteristics – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Role of Entrepreneurship in Economic Development – Factors Affecting Entrepreneurial Growth – Economic, Non Economic, Government Actions.

Module II **(10Hours)**

Entrepreneurial Motivation: Theories and Factors, Achievement Motivation –Entrepreneurial Competencies – Entrepreneurship Development Programs – Need, Objectives – Business Game, Thematic Apperception Test, Self Rating, Stress management.

Module III **(10Hours)**

Small Enterprises – Definition, Characteristics, Project Identification and selection – Project Formulation: Significance, content, formulation of project report – Project Appraisal: Concept and method – Ownership Structures: Selection & Pattern.

Module IV **(11Hours)**

Finance: Need, Sources, Capital Structure, Term Loans – Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts – Working Capital Management: Significance, Assessment, Factors, Sources, Management.

Module V **(10Hours)**

Sickness in small Business: Concept, Signals, Symptoms, Magnitude, Causes and Consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in Small Scale Enterprise – Institutional Support to Entrepreneurs: Need and Support – Taxation Benefits to Small Scale Industry: Need, Depreciation, Rehabilitation, Investment.

COURSE OUTCOMES:

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

1. Explain the types, characteristics of entrepreneurship and its role in economic development.
2. Apply the theories of achievement motivation and the principles of entrepreneurship development program.
3. Select the appropriate form of business ownership in setting up an enterprise.
4. Apply the fundamental concepts of finance and accounting to enterprise.
5. Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.

TEXT BOOKS:

1. S.S.Khanka, "Entrepreneurial Development" S.Chand& Co. Ltd. Ram Nagar New Delhi,1999.
2. Kurahko & Hodgetts, "Entrepreneurship – Theory, process and practices", Thomson learning 6th edition.

REFERENCES:

1. Charantimath, P. M., Entrepreneurship Development and Small Business Enterprises, Pearson, 2006.
2. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.

3. Mathew J Manimala," Entrepreneurship theory at cross roads: paradigms and praxis" Dream tech, 2nd edition 2006.
4. Rabindra N. Kanungo, "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
5. Singh, A. K., Entrepreneurship Development and Management, University Science Press, 2009.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home-work, 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*

5x10marks=50marks

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

PT19 506 (F)	ADVANCE GRAPHICS TECHNOLOGY	L-T-P-C 3-1-0-3

PRE-REQUISITE: Graphics arts techniques.

COURSE OBJECTIVES:

After successfully completing this subject, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Advance Graphics.

SYLLABUS:

Module I **(8 Hours)**

Introduction: Good design, impact of a design on various target audience, role of graphic designer, elements of design, principles of design, language as a communication tool, legibility and readability. **Newspaper:** design elements- text matter, headlines, pictures and advertisements, section pages, color pages. **Books:** Anatomy, page layout, cover design, design approach. **Magazines:** Classification, editorial plan, design approach.

Module II **(11 Hours)**

Pre-production: Introduction, concept of design, storytelling, storyboarding, animatic, character design, visual and look development, sound design, pipeline test, model sheet, layout.
Website: Factors to consider, importance of a site map, content creation, co-ordination of work between various departments, selection of color. **Introduction to Animation:** Perception, history of animation, heritage of animation, types of media for animation, animation production, principles of animation, technical development, animation styles.

Module III **(12 Hours)**

2-D Animation: Overview, 2D Animation basics, 2-D vector animation. An Introduction on how to make drawings for animation, Shapes and forms, About 2d and 3d drawings, Caricaturing – fundamentals, Exaggeration, Attitude, Silhouettes, Boundary- breaking exercises and warm ups, gesture drawing, Line drawing and quick sketches, Drawing from observation, memory and imagination.

Module IV **(12 Hours)**

3-D Animation: Overview, digital computer animation studio, creative and production teams, production process of computer animation. Interface of 3DS max, Understanding the concept of four view ports, Aligning object in the each view port in X, Y, Z axis, Hot keys, User defined hot keys, Using the menus, Floating and docking. Command panel, customizing the interface, Using drag and drop feature, Introduction to different workspaces, "Geometry, Sub objects, Extruding, Welding, bridging etc, Recognizing the workspaces".

Module V **(9 Hours)**

Introduction to standard and extended primitives. "Introduction to creating complex objects with Standard and extended primitives", Understanding the spline tools. Introduction to poly tools. Using modifier stack, navigating the modifier stack, File navigation, Introduction to Connection (Hierarchy, Group, and Link).

COURSE OUTCOMES:

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

1. Explain various levels of design in the field of digital and printing.
2. Explain the types of animation and its role in the industry.
3. Apply the fundamental concepts of 2-Dimensional animation.
4. Know about designing concepts of 3- Dimensional animation.
5. Develop the complex objects using advanced graphics technology.

TEXT BOOKS:

1. The Elements of Design Mark A Thomas, Poppy Evans
2. Essential Principles of Graphic Design : Debbie Millman
3. Engineering Graphic & Design, Pradeep Jain, Khanna Publishing House.
4. Multimedia and Graphics, V.K. Jain, Khanna Publishing House
5. Multimedia & Web Technology, Ramesh Bangia, Khanna Publishing House

REFERENCE BOOKS:

1. Internet and Web Technology, Soma Das Gupta, Khanna Publishing House.
2. Learning Illustrator, Ramesh Bangia, Khanna Publishing House
3. Mastering Photoshop, WebTech Solutions, Khanna Publishing House

4. Engineering AutoCAD, Pradeep Jain & A.P. Gautam, Khanna Publishing House
5. Visual Function: An Introduction to Information Design : Paul Mijksenaar
6. The Functional Art: An Introduction to Information Graphics and Visualization: Alberto Cairo

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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* ***10x5marks= 50marks***

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.

PT19 507(P)	PACKAGING TECHNOLOGY LAB	L-T-P-C 0-0-3-1

PRE-REQUISITE: Packaging Technology

COURSE OBJECTIVES:

- To know about designing and preparation of package designs.
- To know about different types of packaging materials.
- To describe the role of graphic design in packaging.
- To outline the utility of package structural designing software.

List of Experiments

(A minimum of 8 experiments must be conducted)

1. Study of various types of packaging materials
2. Study and operation of various packaging machines.
3. Study of manufacturing of various types of corrugated boards.
4. Study of test conducted on packages.
5. Preparation of layout & package for: Tray & Box, Straight tuck end type carton and Reverse tuck end type carton.
6. Preparation of layout & package for: Full seal end type carton and Bottom inter lock type.
7. Preparation of layout & package for: Window type carton and Visiting card holder.
8. Designing and preparation of designs of paper bags.
9. Designing of packages based on given products.
10. Preparation of packages from given layouts.

COURSE OUTCOMES:

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

1. Know types of tests conducted on packages.
2. Design considering the structural aspects of packages.
3. Optimize material usage in package design.
4. Create designs for packages.

5. Choose suitable material and design for a particular product.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern **(Maximum Marks-100)**

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

20% - Viva voce

10% - Fair record

PT19 508(P)	ELECTRICAL & ELECTRONICS LAB	L-T-P-C 0-0-3-1

PREREQUISITE: Basics of electrical and electronics engineering

COURSE OBJECTIVES:

- Impart basic knowledge in measurement of electrical quantities such as current, voltage and power.
- Verify different circuit theorems.
- To obtain the performance characteristics of DC and AC machines
- Implementation of Basic Electronic circuits.
- To acquire skills in designing analog integrated circuits.
- To study the working of standard digital ICs.

SYLLABUS:

List of Experiments:

(A minimum of 8 experiments must be conducted)

1. Verification of Kirchoff's laws in DC circuit
2. Verification of Superposition theorem in DC circuit
3. Load test on single phase transformer to determine efficiency and voltage regulation at various loads and voltage regulation.
4. 3-Phase power measurement using one wattmeter and two wattmeters.
5. Determination of impedance, admittance, power factor and real/reactive/apparent power drawn in RLC series/parallel circuits.
6. Load test on D.C series motor, Plot the following characteristics
   a) Output Vs efficiency
   b) Output Vs line current
   c) Output Vs Speed
   d) Speed Vs torque
   e) Line current Vs torque

7. Load test on D.C shunt motor, Plot the following characteristics
    a) Output Vs efficiency
    b) Output Vs line current
    c) Output Vs Speed
    d) Speed Vs torque
    e) Line current Vs torque
8. Load test on 3Φ squirrel cage induction motors and obtain & plot the various performance characteristics.
9. Diode & Zener diode characteristics
10. Half wave rectifier and Full wave rectifier.
11. RC coupled amplifier- design for gain - frequency response.
12. RC Phase shift oscillator using BJT
13. Inverting and Non inverting amplifier using op-amp.
14. Familiarization with logic gates.
15. Implementation of logic gates using Universal gates.

COURSE OUTCOMES:

The student will be able to

1. Understand different types of measuring instruments
2. Verify different laws and theorem in electric circuits
3. Measure power and energy in single phase and three phase circuits
4. Understand the performance characteristics of DC and AC machines
5. Understand the working of electronic devices, their performance characteristics.
6. Design circuits for various electronic devices.
7. Design and demonstrate functioning of various analog circuits
8. Understand the working of logic gates and Universal gates.

EVALUATION SCHEME:

Internal Continuous Assessment (Maximum Marks-50)

60%	-	Laboratory practical, record and viva voce
30%	-	Tests
10%	-	Regularity in the class

University Examination Pattern (Maximum Marks-100)

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

PT19 601	SCREEN PRINTING & GRAVURE	L-T-P-C 3-0-1-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To introduce the principles of gravure printing process and cylinder preparation techniques.
- To gain knowledge on components of gravure printing machines.
- To understand the principles of screen-printing process and stencil preparation method.
- To learn about the types of screen-printing machines.
- To know about the print problems & quality control techniques in gravure and screen-printing process.

SYLLABUS:

Module I **(10 Hours)**

History of Screening Printing, **Stencils** – knife cut stencils, photo stencils – Indirect stencil systems, Direct photo stencil systems, capillary systems, Direct/Indirect photo stencil systems. Screening materials. **Screens** – multifilament, mono filaments, selecting mesh material, stretching screen fabric to frame, screen preparation, screen reclamation – Trouble shooting clogged screens. Care and storage of screens. Image transfer – **The squeegee**, Squeegee considerations, squeegee preparation, hardness categories of squeegee blades, Variety of blade shape and application. On contact printing, Off contact printing. **Screen ink** uniqueness – U.V. inks.

Module II **(10 Hours)**

Manual **Printing Process,** Semi-automatic Screen Printing m/c. Automatic Screen Printing m/c. Screen Printing machines – Flat bet hinged frame, Flat bed vertical lift, Cylinder-bed presses, Container printing m/c, Rotary Screen Printing m/c, Carousel m/c. **Special Machine configurations**. Basic registration techniques. Method of halftone preparation for screen printing. **Drying methods** – Evaporation, Oxidation, Penetration, Polymerization. Drying Equipment's – Drying racks, wicket dryers, Jet dryers, Infrared dryers, Ultraviolet dryers. Flocking process. **Application**- Paper and

Paper board, Wood, Textiles, Plastics, Metals, Ceramics and glass. Specialized Areas – Printed circuit boards of screen printing.

Module III **(10 Hours)**

History of gravure, Gravure products and markets – Publication gravure – gravure packaging and converting – product gravure. **Gravure Screens**. Gravure cylinder preparation – Diffusion etch– Direct Transfer-Electromechanical process – Laser cutting. Electronic engraving systems today. Chemical engraving methods and equipment's – cell configurations – advantages and disadvantages. Cylinder correction methods – Re-etching electro mechanical engravings, Colour balance etches, spot plating. Well formation – variables, basic types. Cylinder construction and preparation – Cylinder design, types. Balancing the cylinder. Copper plating and polishing, Re-use of cylinders.

Module IV **(10 Hours)**

Doctor blade – Doctor blade assembly – Blade angles. Blade distance from Nip, Blade edge, Blade mounting. Doctor Blade wear –Fatigue, Corrosion, Abrasive, Adhesive wear, Doctor blade materials, Doctor blade holder configurations, Blade setting procedures, Preparing blade for use, Doctor blade problems. **Gravure Impression Roller** –function, Roller covering, Roller pressure, Cylinder diameter, Roller design & configuration. Balance –static & dynamic. Roller setting. New developments. Storage of impression rollers, Impression roller problems. Impression mechanisms – mechanical, hydraulic, pneumatic.

Module V **(12 Hours)**

A generic printing unit. Typical **press configurations.** – Other gravure presses – Intaglio plate printing, offset gravure and flexo gravure. Gravure with flexo units. Gravure units as other equipment. Gravure roller coating. **Gravure Ink Dryers** – Need for ink dryers, Drying water based inks, Dryers functioning, Dryer limitations, supply air valves, balancing the dryer, filters & dampers, roller condition vital**. Heat Sources** – steam, electric and gas, combination gas / oil, thermic oil, waste heat from incinerators. Solvent Recovery Methods. **Paper substrates** – Roto news papers, Coated papers, Gravure packaging paper substrates – properties. Label stock, Paper board. Non Paper substrates – surface preparation, plastics – properties. Metalized films – Aluminium foil, Foil laminations. Gravure advantages, limitations. Future of Gravure Printing Industry.

COURSE OUTCOMES:

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

1. Summarize the characteristics of gravure printing process and discuss about the methods of cylinder engraving.
2. Explain the components and operation of the different types of gravure presses
3. Analyze the process characteristics of screen-printing technology and relate print quality with the selection of printing components.
4. Compare the stencil preparation techniques and select the type of screen-printing press based on the application requirements.
5. Know about the print problems & quality control techniques in gravure and screen-printing process.

TEXT BOOKS:

1. Babette Magee (1985) "Screen printing Primer", *GATF,* Pennsylvania.
2. Screen Process Printing: A Practical Guide Paperback – (1987) Stephens, John
3. Gravure:- Process and Technology, GAA.
4. Printing Technology, 3rd Edition-Michel Adams, David D Faux.

REFERENCE:

1. Samuel B.H. (1997) "Screen Printing - Contemporary Approach" Delmar publisher, New York
2. Herbert L.W. (1985) "Gravure and flexographic Printing Presses" Converting Technology Co, USA.
3. Ray Blair and Thomas M.D. (1991) "Gravure Process and Technology" GAA, USA.
4. Harry and Smith (1994) "Modern Gravure Technology, A Literature Review" Pira International, UK.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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 5marks= 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.

PT19 602	POST PRODUCTION TECHNOLOGY	L-T-P-C 4-0-0-4

PRE-REQUISITE: Offset Technology

COURSE OBJECTIVES:

Adequate Professional Skills and Competencies in testing the performance of Post production equipment's and materials. And locating the fault at component level and at the stage level.

SYLLABUS:

Module I **(8 Hours)**

Buying Paper, Paper grades, Factors affecting buying of paper, Paper trade, An outline of the procedure for paper and board buying and an appreciation of the value of paper. Paper and board issue including covers for book and flat work. Binding Materials: Covering materials of all types, preparation and treatment in covering. Miscellaneous materials such as thread cords, tapes, mull, eyelets etc. Purchase, selection, care and use of all types of materials. Methods of dealing with fungi and insect pests

Module II **(12 Hours)**

Introduction, Principles of adhesives, operating parameters for adhesives – operative, wet tack, compression, solidification. Types of adhesives – Drying adhesives – solvent based adhesives, water based adhesives, pressure sensitive adhesives. Hot melt adhesives – pressure sensitive hot melts, applying hot melts. Curing adhesives – cure by mixing two or more components, cure when heated, exposure to moisture. Radiation curing, Ultra curing, Pressure sensitive adhesive. Adhesive classes and Properties – Acrylics, animal glues, casein, starch, dextrin, pregelatinized starch, ethylene acetate copolymer, hot melts, polyamide hot melts, polyester hot melts, resin hot melts, natural rubber – latex adhesives, polyurethanes, polyvinyl acetate, poly vinyl alcohol, poly-vinylidene chloride, SBS and SIS block copolymers. Theories of adhesion – mechanical adhesion, chemical adhesion, theories of chemical adhesion – chemical reaction theory, absorption theory, electrostatic theory, diffusion theory, contact angle and wettability.

Module III **(10 Hours)**

General principles of the single knife guillotines. Semiautomatic and automatic programming systems, principles and applications. Three-knife pile trimmers, features and operations of semi-automatic and continuous machines. Mechanism, operation and maintenance of guillotines and three knife trimmers; causes and prevention inaccurate cutting. Production capacities.

Module IV **(12 Hours)**

Basic principles of folding by buckle or combination machines. Setting and operating features, use of predators, creasers and slitters; methods of delivery. Suitability of folding method and machine to job requirements and paper stock. Mechanism, operation and adjustment, of folding machines; causes and prevention of inaccurate folding; maintenance of machine feeders; production capacities.

Module V **(10 Hours)**

Principles of machine gathering types of machines available. Coupling of other units for in-line production. Wire stitching, thread stitching, adhesive binding, sewing. General principles, materials used, styles, varieties and purposes of each method. Spiral wire binding, plastic comb binding, loose-leaf binders; thong and ring binders. Principles and operation of perforating, punching, drilling, round cornering, indexing, creasing, gluing, eye-letting, ruling and numbering. Varnishing, gumming and film lamination machines. Machines used for gathering, collating, insetting and attaching plates.

COURSE OUTCOMES:

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

1. Explain and discuss the print finishing workflow
2. Examine and operate automatic and semi-automatic guillotine machines
3. Plan the sequences suitable for various types of securing operations
4. Design and construct hard case for book binding
5. Examine and operate various print finishing machineries

TEXT BOOKS:

1. A. G. Martin, Finishing Process in Printing, Focal press Ltd., Britain, 1980.
2. T. J. Tedesco, Binding, Finishing and Mailing: The Final World, GATF press, Pittsburgh, 2005.

REFERENCE:

1. U.S. Govt. Printing- Theory and Practice of Book Binding.

2. Aurther W. Johnsori.-The Thames and Hudson Manual of Book Binding
3. Michael Barnard. -Introduction to Print Buying Printing, Bob Thompson, Materials Science and Technology

EVALUATION SCHEME

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 603	DIGITAL PRINTING AND PRE-PRESS	L-T-P-C 4-0-0-3

PRE-REQUISITE: Graphic Design and Electronic Composition

COURSE OBJECTIVES:

- To develop awareness about various digital work flows and technologies in printing
- To create an idea about inkjet printing techniques.

SYLLABUS:

Module I **(10Hours)**

Electrophotography, Ionography, Thermography, Electrography, Photography, X-graphy, Hybrid printing systems, CTF-types, workflow, film materials. CTP- Designs, Plate substrates, workflow, imaging systems CTP for flexographic printing, Computer to cylinder for Gravure printing, Computer to Screen for Screen Printing.

Module II **(10 Hours)**

Computer to Press/Direct imaging**:** Direct imaging with removal of master for each job, Re-imageable Master, Concepts of Re- imageable Master with material application/Ablation- re imageable printing plate systems without material application. Chemical material systems for generating re- imageable surface.

Module III **(10 Hours)**

Digital pre press work flows – Digital description of the Printed Page - Text - Images – Graphics – Layout - The digital page used as a basis from the digital description of the page to its printing. Digital Screening Process – RT Screening, Super cells, irrational screening, output options. Raster Image processor (RIP) – structure & function, interpreter interaction, color data, Rip integration/ execution.- components of digital pre press work flow – data receiving and verification, page layout design, pdf, trapping, pre flighting.

Module IV **(12 Hours)**

Inkjet printing: Introduction and development of the inkjet process over years. Types of Inkjet

Technology, Thermal bubble jet, Piezzo electric and Dye sublimation. Parts of a typical Inkjet Printer:- Print head assembly, Print Head, Ink Cartridges, Ink Cartridge combinations, Separate black and colour cartridges, colour and black in a single cartridge for each ink color. The cartridges with print head itself. Print head stepper motor, Belt, Stabilizer bar, Paper feed assembly, Paper tray / feeder-rollers – paper feed stepper motor, Power supply control circuitry interface port(s)-The Parallel port, USB port, Serial port (SCSI) port. Comparison of inkjet with other types of printers both non-impact and conventional. Application of Inkjet printing in various fields. Scope and development of Inkjet in various industries and ongoing trends.

Module V **(10 Hours)**

Click OK to Print, Computer to Ink jet Printer, Substrate used for inkjet printing- papers types and quality, compatibility of ink and paper, properties of inkjet paper, Other substrates. Long format digital ink jet printing. Areas of application and materials that can be used as substrates. The technology and advantages, Nozzle head, Ink supply, transport mechanism, Software, UV Ink, safety features.

COURSEOUTCOME:

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

1. Examine the various digital imaging processes.
2. Prepare the digital prepress work flow.
3. Testing the performance of inkjet printing and explain its commercial applications.
4. Implement various digital printing processes in printing and packaging.
5. Understand the principles of DTP, CTP, CTF sections.

TEXT BOOKS:

1. H Kippan , *Hand book of Print Media*- Heidelberg.
2. J.Michael Adams, David D Faux, Lloyd, J.Reiber, Printing Technology, 3E, Delma Publishing.
3. Grehard A Northmann, Non Impact Printing.

REFERENCE BOOKS:

1. Martin Graham, Non-Impact Printing, Pira International, UK, 1992.
2. Harald Johnson, Understanding Digital Printing, Thomson Publishers, Boston, 2005.
3. Phil Green, Understanding Digital Color, GATF and PIRA, USA.
4. Romano J F, Professional Pre press, Printing and Publishing, PTR Hall, USA, 1999.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)
20% - 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.

PT19 604	TONE & COLOUR ANALYSIS	L-T-P-C 4-0-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

After successfully completing this subject, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of color management. This paper deals about the concept of tone and the role of color management in printing.

SYLLABUS:

Module I **(12 Hours)**

CIE- Spectral reflectance, CIE color standard , standard observer, tristimulus values Munsell-Munsell Hue circle, CIELAB, CIELUV, metamerism, Memory color, color management-Introduction- WYSWYG- functions of color management, color management module, Color engine, functions of CMM, Principle of color management, models of color management, RGB, HSB,ICC-Colorimeter and spectrophotometer, color calibration.

Module II **(12 Hours)**

Introduction, development of electronic publishing, basic elements of scanners, principles of electronic scanning, basic of electronic scanning, pixels-binary resolution, AM, FM Screening, digital halftones, basic scanner types-pantone-focal tone- true match- special/spot color- application of special color- digital images- sampled images-bitmap- raster- vector graphics. Scanning-automated scanning software, copy dot scanning and rescreening. Image capture elements-photomultiplier tubes, charged coupled device. Scanner adjustments, Scanner workflow, scanner resolution, scanner choice, preparing originals for scanning, types of scanners, working and their advantages. Tone adjustments- White, black point adjustments, gradation, color adjustments, automatic scanners adjustments, color separation.

Module III **(8 Hours)**

Types of originals, transparencies, the ideal transparencies, color correction, need for color correction, Masking, Integral color masking, color printing using standard inks, digital color separation, ink color sequence, brief intro to manual retouching.

Module IV **(8 Hours)**

Masking for color correction, types of masking, positive masking, negative masking, double overlay masking, integral color masking , dye retouching, -chemical correction or reduction , positive dot etching, intensification, unsharp masking, grey balance and tone reproduction.

Module V **(12 Hours)**

Densitometry, type of densities, specular, diffuse, double diffuse density, color printing, factors in color printing, printed color density, n trapping, tone value, additivity and proportionality failure, UCR- GCR, color control strips and punch register system, duo ones- dot area measurement, Murray Davis equation and Yule nelson correction.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Represent colour using different colour models and calculate colour difference.
2. Explain the principle of colour reproduction, evaluate colour originals and choose appropriate reproduction objective.
3. Infer the influence of substrate and ink properties on colour reproduction.
4. Implement suitable method to control colour in press.
5. To familiarize about proofing and colour control techniques.

TEXT BOOKS:

1. Principles of color reproduction- J.A.C. Yale
2. Color – Robin B. McAllister
3. Gary Field, "Colour and its Reproduction", 3rd edition, GATF Press, 2004

REFERENCE:

1. Phil Green, "Understanding Digital Colour", 2nd edition, GATF Press, 1999.

2. R. W. G. Hunt, “The Reproduction of Colour”, 6th Edition, Wiley, 2004

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 605 (A)	PRINTRONICS	L-T-P-C 3-1-0-3

PRE-REQUISITE: Screen Printing & Gravure and Basics of Electronics engineering.

COURSE OBJECTIVES:

- To deal with the methods for collection, classification and analysis of Printed electronics.
- To list and outline the printing techniques used in electronic products manufacturing and the materials used for printed electronics
- To describe and discuss the basics of semiconductors and substrates
- To list and discuss the standard interconnection methods

SYLLABUS:

Module I **(12 Hours)**

Printed Electronics: Introduction, applications, advantages over conventional electronic devices, developments in printed electronics devices, industries and research associations, future scope. Printing Technology in Electronics Manufacturing, PE Technology and Its Benefits, PE Products and Trends, Lighting, Organic/Inorganic Photovoltaics, Displays, Integrated Smart Systems, RFID, Other Electronics and Components

Module II **(8 Hours)**

Printing Technology: Printing Parameters, Screen Printing, Inkjet Printing, Fast Printing: Flexo Printing and Offset-Gravure Printing, Fine Pattern Printing: Nanoimprint, µCP, and Electrostatic Inkjet, Laser-Induced Forward Transfer, Post-treatment Process

Module III **(12 Hours)**

Materials For Printed Electronics: Varieties of Conducting Materials, Metallic Nanoparticles, Metal-Organic Decomposition Ink, Nanowires; Applications to Transparent Conductive Films, Low Temperature Fabrication of Metal Nanowire TCF

Inks: Polymer and water based conductive inks, properties - chemical, electrical and printability. influence of different inks on the electrical and magnetic characteristics of printed organic devices, nano technology - carbon nanotube and silver nanotube.

Module IV **(8 Hours)**

Semiconductors And Substrates: Semiconductor Category and History, Organic Semiconductors, Oxide Semiconductors, Other Semiconductors; Substrate-Polymeric film, glass, paper; Barrier Film Technology.

Module V **(12 Hours)**

Interconnection And Standards: Choice of Interconnection Methods- Soldering, Adhesives; Conductive Adhesives- Isotropic Conductive Adhesives- Anisotropic Conductive Adhesives- Interconnection Reliability; Standards-ISO, IEC, IEE, IPC.

Products and Quality Control: PCB, RFID, OLED, OFET, printed batteries, flexible display, smart packaging, photo detectors, solar cells - construction and working principles, calibration, characterization and standardization. quality control and measuring devices.

COURSE OUTCOMES:

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

1. Explain and restate the basics of printed electronics.
2. Compare and contrast the suitability of printing processes for various electronic products.
3. Compare and discuss about the materials and the techniques involved in printed electronics.
4. List and discuss the basics of semiconductors and substrates.
5. Outline and restate various standards in printed electronics.

TEXT BOOKS:

1. Katsuaki Suganuma 'Introduction to Printed Electronics', Springer, 2014

REFERENCES:

1. John Birkenshaw 'Printed Electronics' Pira International, 2004

2. Jutta E. M Rasp 'Flexible and Printed Electronics Explained: Technology and Commercial Applications', John Wiley & Sons, Limited, 2015.
3. Pudas, M., Halonen, N., Granat, P., Vahakangas, J., Gravure Printing of Conductive Particulate Polymer Inks on Flexible Substrates, Progress in Organic Coatings, 2005.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)
20% - 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.

PT19 605 (B)	MULTIMEDIA	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To learn the importance of graphics in multimedia application
- To understand the various digital formats
- To understand the web development tools

SYLLABUS:

Module I **(10 Hours)**

Fundamental concepts and Design of a multimedia production - Script, Flowchart & Storyboard. Multimedia Building Blocks- Text: Text as a part of multimedia project, Text design basic, Fonts, Types of fonts, True type fonts, Hypertext, Hyper Media. Multimedia Building Blocks-Graphics: Why Graphics are important in multimedia application, Different kinds of graphics, Source of graphics, Graphics acquisition.

Module II **(8 Hours)**

Multimedia Building Blocks - Sound & Video: Importance of sound & Video in multimedia application, Elements of sound, analog & Digital sound, Recording, Digitizing, Sound format, Editing, Mixing of sound. Elements of Video, Analog & digital Video, Video Capture, Editing, Application of Video in multimedia- video size, frame rate, Image quality, Resolution.

Module III **(12 Hours)**

Introduction- Basic theory, sound, sound of physics, human hearing mechanism, recording technology- microphone, amplifier, equalizer, sampling MIDI, file formats (image & sound file formats) digital audio, GIF, Bit map, image capturing & editing**.** Software supports-Basic tools painting & drawing tools, image editing tools, OCR software's, sound editing, animation, video and digital movies. Digital video and editing Basic compression techniques, lossy and lossy compression, digital video formats – quick time, JPEG, MPEG, editing software-premier, Digitizers video formats.

Module IV **(10 Hours)**

Authorizing tools- card based tools, icon-based tools, time-based tools, object-oriented tools. Macromedia author ware-Macromedia director with lingo creating a presentation using sound text, images, video, interactive icon, calculating icon, navigation, frame work icon, decision icon.

Module V **(12 Hours)**

Introduction to web development, History, Introduction to web development tools, Web designing, Web designing tools, Web designing techniques, Introduction to HTML, XHTML, XML etc. The use of Cascading Style sheets (CSS) in web development, Scripting, client side scripting, Server side scripting, ECMA (ECMA Scripting), Web development techniques, Web development as an industry, End users (browsers used, web standards, accessibility etc.), Introduction to W3C (World Wide Web Consortium), Future of Web development.

COURSE OUTCOME:

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

1. State the graphic design principles in the production of visual messages
2. Explain the elements of graphic design
3. Explain the graphic design softwares and formats
4. Discuss about the different types of tools in multimedia
5. Explain the basics of web designing

TEXT BOOKS:

1. Corel Draw-8 Tata McGraw Hill.
2. Adobe Photoshop Lightroom 5: Classroom in a Book 1st Edition

REFERENCE:

1. Adobe premiere 5- Classroom in a book- Tech media
2. Inside Macromedia Director 6 with Lingo- Tech media
3. Authorware an introduction to multimedia- Simon Hooper

EVALUATION SCHEME:

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2)

20% - 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.

PT19 605 (C)	SCANNERS AND SYSTEMS	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To learn the fundamentals of scanners management system.
- To understand the device variables and procedure for device characterization.
- To comprehend issues in scanners conversion.
- To familiarize about press standardization.

SYLLABUS:

Module I **(12 Hours)**

Basic principles of a scanner, vario klishograph , The Neugebauer formula , Relative study of Crossfield Di nippon Screen, Hell, Royal Zenith, Scitex and Itek colour scanner. Mechanics and functions of a scanner signal flow in the scanning section-signal processing in the computer. Analog and digital computers- signal processing in the colour computer-Function of scale computer.

Module II **(8 Hours)**

The basic Mechanics of a exposing section, Operator's features, Poly chromatic Colour Removal (PCR) Pastel colour boost, flexible unsharp Masking Scanner generated vignettes- Step and repeat, Expose cylinder, film loading, optical system.

Module III **(12 Hours)**

Light source : Xenon lamp and laser exposure unit , scanner data terminal , disk drive unit, Scanner initialization, cleaning the original , mounting copy of the scanning drums ,cylinder change analyse optic procedure , setting focus, aperture and filter, adjusting the lamp house optics: centring the spot, setting vertical resolution , expose optic procedure, setting cylinder size , setting expose turret , setting laser power, Film procedure Loading film , unloading film, safety precautions and environment conditions , general precautions.

Module IV **(12 Hours)**

Colour separation by flatbed scanners , Links from the Desktop to the High end vertical type drum

Scanners-working principle , Mechanical and Optical consideration , Text and Graphis combination , Imagesetters , Raster Image Processor (RIP), Creating digital images , Designing the electronic page , Imaging System Technology and Operation , Elements of digital image processing system ,Cloning or pixel replacement , Data compression and transmission.

Module V **(8 Hours)**

Calibration , positioning traverse, setting the starting point of the original ,enlargement and final size, scan rate, format, auto format, customer values , Luminosity curves, tone, neutral tone boost, colour correction, removal and addition of colour cast, grey balance set up procedure, catchlight, color negative scanning, limit and line mode, Image processing concept, Systems technology , Arrival of images on Disk , Electronic assembly and the layout, cleaning of optics, printer disk care , disk unit cleanliness, temperature and humidity control , scanner unit daily, weekly maintenance fault finding chart , operator error messages, machine fault messages.

COURSE OUTCOMES:

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

1. Infer the steps in implementing scanner management system and choose suitable device configuration for colour measurement following quality standards.
2. Create profiles for display, input and output devices.
3. Explain the gamut mapping concepts by applying boundary constraints
4. Design methodology to standardize the various printing processes as per ISO standards
5. Reproduce and match scanner across various devices and software applications.

TEXT BOOKS:

1. Eric Chambers, Reproduction Photography for lithography, GATF, 1979.
2. J. Michael Adams, David D. Faux, Llyod J. Ribber, Printing Technology,3rd ed., Delmar 1968.
3. Gary, G. Field Colour Scanning and Imaging System, GATF, 1990.

REFERENCES:

1. Crossfield Operator's manual-6500-8090-03A, 1989.

2. Surrey, Graphic Repro, Eaglehead Publishing Ltd., , U.K., 1984.
3. Dr. R. Molla, Eletronic Colour Separation, R.K. Printing & Publishing Company, West Virginia.
4. Bill Parsons, Electronic prepress: An Introduction, Delmar Publishers, 1994.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50***)*

70% - Tests (minimum 2)

20% - 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.

PT19 605 (D)	BOOK PUBLISHING	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To impart knowledge of publishing process and book publishing organization.
- To impart knowledge on areas of publishing, editorial process, production management, distribution methods and legal aspects involved in book publishing.
- To understand the components of digital workflow
- To carry out the production and cost estimation for book production.

SYLLABUS:

Module I **(12 hours)**

Publishing organization. Areas of publishing - general publishing, educational publishing, professional publishing and reference publishing. Publishing house - the role of commissioning editor, the desk editor, the designer, the production manager, the sales /marketing manager, the publishing manager. Editorial process and development. Copy editing, Page makeup, Proofs; the book editor – multipurpose functions, Discussion with author, Editing educational material, decision making role; editorial technique – style sheet, reference aids; the author and his manuscript - unsolicited manuscripts, author-publisher, professional guides and societies, the literary agent, author publisher relationship, writing textbooks for children.

Module II **(10 hours)**

Education and estimating in book publishing. Pre-production planning, Manuscript, layout and design, imposition, composition, Anatomy of a book; Printing techniques; Production Process; technical aspects of production; Quality control - Proofing stage; financial aspects; first copy cost, manufacturing cost, overheads; Economics of publishing - net book, non-net book, variations in price, published price of a book.

Module III **(10 hours)**

Promotion channels, distribution outlets and sales techniques. Direct Promotion Techniques, mail order advertising, subscription books, Direct mail promotion, Library purchases, export and import of books, publishers and book sellers' catalogues, publicity campaign, paperback distribution, the central book clearing house, economics of distribution, the role of bookshop -Booksellers associations, laws and ethics; University, college and Professional Publishing council, Book marketing council, Book development council.

Module IV **(10 hours)**

Book binding, print finishing and legal aspects. Manmade binding, Perfect binding, mechanical binding, loose leaf binding, securing operation, automatic & semi-automatic binding machines, computerized binding, finishing operation; laminating, varnishing, gold foiling, die stamping, rounding, cornering, punching, drilling etc; copy right.

Module V **(10 hours)**

Digital Publishing and Legal aspects of book publishing: Software needs, manuscript formats and file management, editing tools, web design and publishing; copy right, types of agreement between author and publishers, agreement of sale of translation rights, illustration and artwork agreement, the outright sale of the copyright, profit sharing agreement, the royalty system, commission agreement.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Identify the responsibilities and functions of publishing house.
2. Analyze the author publisher relationship and editor's functions.
3. Analyze book distribution and copyright agreements.
4. Impart knowledge on legal aspects of book publishing issues.
5. Promote the basic understanding of sales techniques, promotion channels and distribution.

TEXT BOOKS:

1. D. Raghavan, An introduction to Book Publishing, Institute of Book Publishing, New Delhi,1988.
2. John P. Dessauer, Book Publishing, R.R. Bowker Company, New York & London, 1981.
3. Roy Paul Nelson, Publication Design, Wm. C. Brown Company Publishers, Dubugue, Lowa,1983.
4. Charles Clark, Publishing agreement, George Allen &Unwin, London, 1984.
5. Book Production Practice, Second Edition, Publishers Association, British Printing Industries Federation, 1984.
6. Clive Bradley, Publishing A vital National and International Asset, Secretary and Chief Secretary, The Publishers Association, 1982.

REFERENCE:

1. Adrain Bullock, Book Production, Routledge, First Edition, 2012
2. Frania Hall, The business of Digital Publishing, Routledge, Fifth Edition, 2013
3. G.S.Jolly, Book Publishing Management, Har-Anand Publication, First Edition, 2009.
4. Lynette Owen, Clark's Publishing Agreements: A Book of Precedents, Bloombury Publications, Ninth Edition, 2013
5. Giles Clark and Angus Phillips, Inside Book Publishing, Routledge, Fifth Edition, 2014

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home-work, 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.

PT19 605 (E)	PACKAGING LAWS AND REGULATIONS	L-T-P-C 3-1-0-3

PRE-REQUISITE: Packaging Technology

COURSE OBJECTIVES:

- To understand the various rules and regulations with respect to packaging in India
- To comprehend the international laws with relation to various forms of Packaging
- To have a knowledge about the various International and National laws and regulations with respect to packaging.

SYLLABUS:

Module I **(8 Hours)**

Indian Regulatory System: Introduction, The Standards of weights and Measures Act (SWMA), Standard Units, Laws, Regulations and Ministries involved, Essential Commodities Act, Agricultural Produce (Grading and Marketing) Act, Prevention of Food Adulteration Act, Codex Standard Act, Export (Quality Control and Inspection) Act, Bureau of Indian Standards.

Module II **(12 Hours)**

Declarations on Packaged Commodities: Declarations for Interstate Trade and Commerce, Standard Packages, Maximum Permissible Error, Label Declarations, Standard Quantity specifications for various products, Symbols and Units used.

Module III **(12 Hours)**

International Laws and Violation of Law: Uniform Weights and Measures Law, Uniform Packaging and Labelling Regulation (UPLR), Uniform Unit Pricing Regulation (UPR), Details of Violations, offences, Penalties under various sections, EUREACH Regulations in packaging.

Module IV **(6 Hours)**

Packaging Storage Requirements: Various storage requirements of Products, Specifications of Raw Materials used, is Specifications with respect to packaging and Packaging Materials

Module V **(12 Hours)**

Packaging Requirements and PFA: Packaging requirements under PFA, Declaration and Labelling, Specification of Display panels, Statutory Requirements on Packages, PFA Enforcement methods, Fruit Products Order (FPO) Meat Food Products Order (MFPO) Agricultural Grading and Marking Rules (AGMARK), Edible Oil Packaging (Regulatory) Order.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Understand the various rules and regulations with respect to packaging in India
2. Comprehend the International laws with relation to various forms of Packaging.
3. Know about the various International and National laws and regulations with respect to packaging.
4. Know about packaging requirements.
5. Know about Indian regulatory system of packaging.

TEXT BOOKS:

1. G C P Range Rao," Modern Food Packaging, Packaging Laws and Regulations", CFTRI Mysore, IIP Publications, 2005
2. The Standards of Weights and Measures act, (1976) & Standards of Weights and Measures (Packaged Commodities) Rules (1977), Rule Book, Govt. Of India.
3. BIS Rule Book, Govt. Of India.

REFERENCE:

1. ISO 13485- Medical Device – Quality Management Systems Requirements for regulatory purposes
2. US FDA 21 CFR 820: Medical Devices – Quality system regulations
3. ASTM D 4169: Standard Practice for Performance Testing of Shipping Containers and Systems
4. ASTM-F 1980: Standard Guide for Accelerated Aging of Sterile Barrier Systems for Medical Device

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 605 (F)	ANALYSIS OF PRINTING INK	L-T-P-C 3-1-0-3

PRE-REQUISITE: Paper & Ink

COURSE OBJECTIVES:

- To study the raw materials for the preparation of printing inks
- To provide the knowledge on ink formulation and manufacturing methods
- To discuss the different speciality inks and drying mechanism.
- To give the importance and types of various surface treatment methods and coatings.
- To analyse the ink related problems and testing methods.

SYLLABUS:

Module I **(11hours)**

Colourants – Classification, preparation and properties; Inorganic – white and coloured, carbon black, metallic, ultramarine and fluorescent; organic - Diarylide yellow, Hansa yellow, Rhodamine, Lithol, Rubine; Dyestuffs and oils - Types, Preparation, Properties and uses; Varnishes-types, applications; Solvents - General properties; Resins – Natural Rosin and its derivatives and Gum arabic; Synthetic – Rosin modified fumaric, maleic and phenolic, alkyds, hydro carbons, polyamides, Polyvinyl, Epoxy resins, Acrylic resins, Ethyl Cellulose and Nitrocellulose; Additives–Properties and applications. Driers, Waxes, Antioxidants, plasticizers, wetting agents, defoaming agents and Anti-skinning agents.

Module II **(11 hours)**

Offset Inks – Pigments, Resins, Vehicles, Plasticizers, Additives, Ink dispersion, Ink rheology and variables; Inks for sheet and web. Flexography Inks – colourants, pigments and dyes, selection criteria, Ink vehicle and its properties, resin types and selection criteria, Additives, Ink rheology, Inks for paper, plastics and foil; Gravure Inks – colourants, Vehicles, solvents, Ink additives, Publication gravure inks, Packaging and product inks, rheology; Screen inks - Constituents, Properties, Inks for paperboard, plastic containers, textile inks, impervious substrates and metallic substrates;

Manufacturing methods – Paste inks, Liquid inks, premixing, Flowchart - Ball mill, Bead mill and Triple roll mill.

Module III **(10Hours)**

Metallic Inks, Fluorescent Inks, Fugitive, Penetrating, Magic Inks, Invisible Inks, Polybond Inks, Mellow Inks, Carbonising Inks, Radiation curable inks-IR, UV & EB–Raw materials, equipment used for drying; Security inks– Thermochromic and Photochromic; Nano-inks; Ink drying mechanisms.

Module IV **(10 Hours)**

Importance and Scope of surface modification, Surface Energy, Role of surface roughness, Methods – Chemical, Corona Treatment, Plasma Treatment, Laser assisted modification, Coating types - Oil based, water based, UV and EB coatings and nano emulsions, Roller coatings and Hybrid coatings - constituents, properties.

Module V **(10 Hours)**

Viscosity, Tack, Colour, Gloss, Rub resistance, Length, Drying Characteristic, and Fineness of grind gauge, light fastness, Effect of temperature and humidity; Standards on environmental concerns, end use applications, Ink problems related to printing processes – Trouble shooting.

COURSE OUTCOMES:

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

1. Select suitable raw material for ink preparation.
2. Comprehend the manufacturing process of Inks.
3. Recognize the suitable ink drying mechanism
4. Select the coating and surface modification methods.
5. Follow the standards and rectify the problems used for testing of printing Inks.

TEXT BOOKS:

1. Steven Abbott, Nigel Holmes, "Nanocoatings: Principles and Practice: From Research to Production", DesTECH Publications, 2013.
2. Robert F Reed, What the Printer should know about inks, GATF

REFERENCES:

6. Hans-Joachim Streitberger, Artur Goldschmidt, "Basics of Coating Technology", European Coatings Library, 2018.
7. Joanna Izdebska, Sabu Thomas, "Printing on Polymers", Elsevier, 2016.
8. Robert Leach, "The Printing Ink manual", Springer, 2012.
9. Sam Zhang, "Thin Films and Coatings", CRC Press, 2016
10. Steven Abbott, Nigel Holmes, "Nanocoatings: Principles and Practice: From Research to Production", DesTECH Publications, 2013.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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 ***10x5marks=50marks***.

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.

5x10 marks=50marks.

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

PT19 606 (A)	PRODUCT DESIGN AND DEVELOPMENT	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES

- To understand the global trends and development methodologies of various types of products and services.
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems.
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification.
- To understand system modelling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics generation devices.

SYLLABUS:

Module I **(10 Hours)**

Introduction: Classification/ Specifications of Products. - Product life cycle. Product mix. - Introduction to product design. - Modern product development process- Innovative thinking. - Morphology of design.

Module II **(10 Hours)**

Conceptual Design: Generation, selection & embodiment of concept. Product architecture. Industrial design: process, need. Robust Design: Taguchi Designs & DOE. Design Optimization.

Module III **(10 Hours)**

Design for Manufacturing & Assembly: Methods of designing for Manufacturing & Assy. Designs for Maintainability. Designs for Environment. 3Product costing. Legal factors and social issues. Engineering ethics and issues of society related to design of products.

Module IV **(11 Hours)**

Value Engineering / Value Analysis: Definition. Methodology. Case studies. Economic analysis: Qualitative & Quantitative.

Concurrent Engineering, Rapid prototyping, Tools for product design – Drafting/Modelling software.

Module V **(11 Hours)**

Ergonomics / Aesthetics: Gross human autonomy. - Anthropometry. - Man-Machine interaction. - Concepts of size and texture, colour. Comfort criteria. - Psychological & Physiological considerations. - Creativity Techniques: Creative thinking, conceptualization, brain storming, primary design, drawing, simulation, detail design.

COURSE OUTCOMES:

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

1. Define, formulate and analyze a problem.
2. Solve specific problems independently or as part of a team.
3. Gain knowledge of the Innovation & Product Development process in the Business Context.
4. Work independently as well as in teams.
5. Manage a project from start to finish.

TEXTBOOKS

1. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
2. Kevin Otto & Kristin Wood Product Design: “Techniques in Reverse Engineering and new Product Development.” 1 / e 2004, Pearson Education New Delhi

REFERENCE BOOKS

1. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
2. Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, Second Edition, Prentice Hall, 2003.
3. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2003.

EVALUATION SCHEME:

Internal Continuous Assessment **Maximum Marks-50**

70% - Tests (minimum 2)

20% - 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*

10x5marks= 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

5x10 marks= 50 marks

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

PT19 606 (B)	RESEARCH METHODOLOGY	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- Research Methodology is a way to systematically solve a research problem.
- It aims to give the work plan of research.
- It provides training in choosing methods materials, scientific tools and techniques relevant to the solution of the problem.

SYLLABUS:

Module I **(8 Hours)**

Objectives and types of research: Motivation and objectives, Research methods vs Methodology. Types of research, Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.

Module II **(12 Hours)**

Research Formulation: Defining and formulating the research problem, Selecting the problem, Necessity of defining the problem, Importance of literature review in defining a problem, Literature review, Primary and secondary sources, reviews, treatise, monographs-patents, web as a source, searching the web, Critical literature review, Identifying gap areas from literature review, Development of working hypothesis.

Module III **(12 Hours)**

Research design and methods: Research design, Basic Principles, Need of research design,– Features of good design, Important concepts relating to research design, Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis, Experimentation, Determining experimental and sample designs.

Module IV **(8 Hours)**

Data Collection and analysis: Execution of the research, Observation and Collection of data, Methods of data collection, Sampling Methods, Data Processing and Analysis strategies, Data Analysis with Statistical Packages, Hypothesis-testing, Generalization and Interpretation.

Module V **(12 Hours)**

Reporting and thesis writing : Structure and components of scientific reports , Types of report, Technical reports and thesis , Significance , Different steps in the preparation, Layout, structure and Language of typical reports , Illustrations and tables , Bibliography, referencing and footnotes , Oral presentation , Planning , Preparation , Practice , Making presentation , Use of visual aids , Importance of effective communication, Application of results and ethics, Environmental impacts , Ethical issues , ethical committees , Commercialization , Copy right, royalty, Intellectual property rights and patent law, Trade Related aspects of Intellectual Property Rights, Reproduction of published material, Plagiarism, Citation and acknowledgement , Reproducibility and accountability.

COURSE OUTCOMES:

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

1. Identify and discuss the complex issues inherent in selecting a research problem,
2. Selecting an appropriate research design, and implementing a research project.
3. Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.
4. Formulate research designs and methods, basics principles etc,
5. Know about Reporting and thesis writing.

TEXT BOOKS:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
3. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.

REFERENCE:

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
3. Wadehra, B.L. 2000. Law relating to patents, trade-marks, copyright designs and geographical indications. Universal Law Publishing.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 606 (C)	INDUSTRIAL POLLUTION CONTROL	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To impart the basic concepts of industrial pollution control
- To develop understanding about water, air, light pollution control.

SYLLABUS:

Module I **(8 Hours)**

Classification of industrial wastewater - types of pollutants and their effects - monitoring and analysis methods - water pollution laws and standards - industrial wastewater treatment - processes and equipment.

Module II **(12 Hours)**

Water pollution control in industries - pulp and paper, textile processing, tannery wastes, dairy wastes, cannery wastes, brewery, distillery, meet packing, food processing wastes, pharmaceutical wastes, chlor-alkali industries, fertilizer industry, petrochemical industry, rubber processing industry, starch industries, metal industries, nuclear power plant wastes, thermal power plant wastes.

Module III **(10 Hours)**

Air pollution control in industries: source and classification of industrial air pollutants - monitoring equipment and method of analysis - damages to health, vegetation and materials -air pollution laws and standards - treatment method in specific industries - thermal power plants - cement - fertilizers - petroleum refineries - iron and steel - chlor-alkali - pulp and paper.

Module IV **(12 Hours)**

Industrial odour control - sources and solutions - odour control by adsorption and wet scrubbing - industrial noise control methods - sludge treatment and disposal – industrial hazardous waste management, waste minimization. Environmental Impact Assessment and risk assessment- Environmental Audit and Environmental management system- Concept of common effluent treatment plants.

Module V **(10 Hours)**

Methods of Primary treatments: Screening, Sedimentation, Flotation, Neutralization, and methods of tertiary treatment. Brief studies of Carbon absorption, Ion exchange, Reverse osmosis , Ultra filtration , Chlorination , Ozonation, treatment and disposal.

COURSE OUTCOMES:

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

1. Understand the basic concepts of industrial pollution control
2. Identify the water pollution control.
3. Design and formulate the air pollution.
4. Explain about light pollution control.
5. Prepare the primary treatment methods of various pollution.

TEXT BOOKS:

1. Nelson & Nemerow, Industrial Water Pollution-Origin, Characteristics and treatment, Addison, Wesley Publishing Co.
2. Rao C.S., Environmental Pollution Control Engineering, New Age Int. Pub.

REFERENCES:

1. Gerard Kiely, Environmental Engineering, McGraw Hill
2. Rao M.N. & Rao H, Air Pollution, Tata McGraw Hill
3. Sincero A.P.& Sincero G.A., Environmental Engineering, A Design Approach, Prentice Hall of India
4. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw Hill
5. Babbitt H.E, Sewage & Sewage Treatment, John Wiley
6. Abbasi S.A, & Ramasami E, Biotechnical Methods of Pollution Control, Universities Press(India) Ltd.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 606 (D)	MARKETING MANAGEMENT	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To introduce the students to the concepts of marketing and emphasis the role of marketing in organization.
- To develop understanding about the performance of buying and pricing concepts.

SYLLABUS:

Module I **(10 Hours)**

Needs, wants and demands, products, value, cast and satisfaction, exchange, transactions and Relationships, markets, marketing and marketers, company orientation towards the market place production concepts, product concept, selling concept, marketing concept, societal marketing concept. Adoption of marketing management-In business sector, in non profit sector, in international sector. Marketing as a managerial function, role of marketing in modern organizations. Corporate strategic planning- Corporate mission, strategic business unit identification, evaluating the current business portfolio, corporate new business plan.

Module II **(10 Hours)**

Business strategy Planning- Business mission, external environmental analysis, internal environment analysis, goal formulation, strategy formulation, are grain formulation, implementation, feedback and control. Market opportunity –Size of market, demand analysis, industry analysis, competition analysis, segmentation analysis. Product market selection, approaches to marketing planning-PIMS, BCG. Structure of marketing plan, process of marketing planning.

Module III **(10 hours)**

Concept of MIS, components of MIS, internal record system, marketing intelligence system, marketing research system, suppliers of MR, scope of MR. The research process-problem definition, statement of research objectives, research design, exploratory, descriptive, causative. Sources of data- Primary source of data, secondary data, advantages of sec. data, new age of secondary information. Data collection- procedure, tools. Data analysis. Report and presentation. Identifying the company's competitors, industry concept of competition, market concept of competition, identifying the competitors strategies, determining the competitors objectives, assessing the competitors strengths & weakness. Estimating the competitions reaction patterns. Designing the competitive intelligence system.

Module IV **(11 hours)**

Concept in demand measurement, estimating current demand, estimating future demand-Survey of buyers intentions, composite of sales force opinions, expert opinion, market test method, time series analysis, statistical demand analysis. New product decisions. The era of new product, what is a new product, factors contributing new product development-Changing customers preferences, technological changes, govt. policy. New product development process- idea generation, identifying prospective customers, concept development & testing, feasibility analysis, product development, test marketing, commercialization. Organization of new product, internet and new product development. Designing marketing strategies for market leaders, challenges, followers & Nichers-Market lead strategies-expanding the total market, defending market share, marketing strategies, Expanding market share. Market challenger strategies strategic objectives and opponents. Market follower strategies, market Nichers strategies.

Module V **(11 Hours)**

Direct Marketing-nature, growth, advantages. Major tools of direct marketing, development of integrated direct marketing, maxi marketing model for integrated marketing, major decisions in direct marketing. Public relations-decisions in marketing PR, tools in marketing PR. Principles of personal selling- selling, the variety of selling styles & buying styles, negotiation, principled negotiation approved to bargaining, bargaining tactics, relationship management, when & how to use relationship management. Marketing organizations evolution of marketing dept. ways of organizing marketing department, strategies for company wide marketing orientation. Marketing implementation-diagnostic skills, Evaluating and controlling marketing performance. Annual-plan control-Sales analysis, Market share analysis, financial analysis, customer satisfaction trading, corrective action. Profitability control, Efficiency control, Strategic control, Marketing controller concept.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Explain the basic concepts in marketing.
2. Make the various buying behavior methods.
3. Analyze the various product pricing concepts.
4. Define the various marketing planning principles and its strategies.
5. Prepare an analytical method of advertising, sales and promotion methods.

TEXT BOOKS:

1. Philip Kotler.- Marketing Management & Analysis Planning Implementation & Control.
2. Rajan Saxena- Marketing Management Reference Books.

REFERENCE:

1. Marketing Management- Planning, Implementation & Control- 3rd edition, V Ramaswamy S Namakumari.
2. Strategic Marketing Management- 2nd edition- Carol H Andreson, Julian W Vincze
3. Adrain palmer, "Introduction to marketing theory and practice", Oxford university press IE 2004.
4. Czinkota & Kotabe, "Marketing management", Thomson learning, Indian edition 2007.
5. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of Inida-1997.
6. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, XII Edn, 2000.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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.

PT19 606 (E)	QUANTITATIVE TECHNIQUES FOR ENGINEERS	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES

- Understand the importance of the use of OR application in decision Making environment
- To formulate LPP and Obtain Graphical Solutions & Acquire General idea of the Simplex method.
- To understand and solve transportation & assignment models.
- To know optimal sequence model and understand concepts of queuing theory.
- To identify right time for replacement of equipment and understand project management techniques and statistical tools for data analytics.

SYLLABUS:

Module I **(9 Hours)**

Operations Research & Decision Making Environments Operations Research: Uses, Scope and Applications of Operation Research in managerial decision-making. Decision-making environments:- Decision-making under certainty, uncertainty and risk situations; Decision tree approach and its applications.

Module II **(10 Hours)**

Linear Programming Problem & Transportation Problem Linear programming: Mathematical formulations of LP Models for product-mix problems; graphical and simplex method of solving LP problems; duality. Transportation problem: Various methods of finding Initial basic feasible solution-North West Corner Method, Least Cost Method & VAM Method and optimal solution-Stepping Stone & MODI Method, Maximization Transportation Problem

Module III **(11 Hours)**

Assignment model & Game Theory Assignment model: Hungarian Algorithm and its applications, Maximization Assignment Problem. Game Theory: Concept of game; Two-person zero-sum game; Pure and Mixed Strategy Games; Saddle Point; Odds Method; Dominance Method and Graphical Method for solving Mixed Strategy Game.

Module IV **(10 Hours)**

Replacement Problem & Project Management Replacement Problem: Replacement of assets that deteriorate with time, replacement of assets which fail suddenly. Project Management: Rules for drawing the network diagram, Applications of CPM and PERT techniques in Project planning and control; crashing of operations.

Module V **(12 Hours)**

Sequencing & Queuing Theory Sequencing Problem: Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, Two jobs and m - Machines Problems. Queuing Theory: Characteristics of M/M/I Queue model; Application of Poisson and Exponential distribution in estimating arrival rate and service rate; Applications of Queue model for better service to the customers (simple problems only), Basics of statistical tools like median and mode, Range, dispersion, standard deviation, hypothesis testing, coefficient of variation, and regression analysis for data analysis, Basics of management simulation.

COURSE OUTCOMES

By leaning this course, the students should be able to

1. Understand the characteristics of different types of decision-making environments and the appropriate decision-making approaches and tools to be used in each type.
2. Formulate linear programming problem and to find optimal solution by graphical simplex method
3. Build and solve Transportation Models and Assignment Models also to solve game theory problems by understanding pure and mix strategies.
4. Assign optimal sequence of difference jobs on different machines and develop understanding of queuing theory concepts and do statistical data analysis.
5. Implement replacement of equipment’s at right time and able to implement project management concepts like CPM, PERT to reduce cost and time.

TEXT BOOK:

1. N. D. Vohra- Quantitative techniques in Management, 5^{th} Edition, Tata McGraw-Hill, 2017.
2. P. C. Tulsian, Vishal Pandey, Quantitative techniques in Management, 5^{th} Edition - Pearson, 2002.
3. U. K. Srivasthava, Quantitative techniques in Management, 3^{rd} edition, New Age International Private Limited, 2011.
4. R. Panneerselvam - Operations Research, 2^{nd} Edition, PHI, 2006.
5. Ravindran, Phillips, Solberg- Operations Research Principles and Practice, 2^{nd} Edition,Wiley,2007
6. Sharma J. K. - Operations Research, 6^{th} Edition, Laxmi Publications, 2017.
7. M. Mahajan, Statistical Quality Control, 7^{th} Edition, Dhanpat Rai Publishing Co Pvt Ltd, 2018.

REFRENCE BOOKS:

1) Taha Hamdy - Operations Research - An Introduction, 10^{th} Edition, Pearson Education India, 2019.
2) S. Kalawathy-Operation Research, 4th Edition, Vikas Publishing House, 2012
3) Natarajan, Balasubramani, Tamilarasi, Operation Research, Pearson Education India; 2nd edition, 2014.
4) C. R. Kothari - Quantitative Techniques, 3^{rd} edition, Vikas Publishing House, 2013.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 606 (F)	DISASTER MANAGEMENT	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To provide basic conceptual understanding of disasters and its relationships with development.
- To understand approaches of Disaster Risk Reduction and the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To understand Medical and Psycho-Social Response to Disasters.
- To enhance awareness of Disaster Risk Management institutional processes in India
- To build skills to respond to disasters.

SYLLABUS:

Module I: **(12 Hours)**

Introduction- Hazard, Vulnerability, Risk, Disaster, classification of disasters, Risk and vulnerability analysis. Risk reduction-strategic development for vulnerability reduction, Disaster prevention and mitigation.

Natural disasters: water and climate based disasters-Earthquakes, Tsunami, Floods, Drought, Landslides, Cyclones and Volcanic eruptions, flood-hail storms, cloudburst, cyclones, heat and snow avalanches, cold waves, droughts, sea erosion, thunder and lightning. Geological disaster: landslides, earthquakes, Tsunami, mine fires, dam failures and general fires. Biological disaster: pest attacks, cattle epidemic and food poisoning, nuclear accidents, and industrial disaster: chemical and industrial disasters. Do's and Don'ts in various disasters. Accidental disaster: urban and forest fires, oil spill, mine flooding incidents, collapse of huge building structures and bridges. Accidents: Air, Sea, Rail & Road.

Note: (Basic concepts only and explanation can be done with discussing case studies)

Module II*:* **(10 Hours)**

Disaster preparedness and response concept and nature disaster preparedness plan prediction, role

of information, education, communication, and training. Disaster management: Role of Government, international and NGO bodies, Role of it in disaster preparedness role of engineers on disaster management. Disaster response: Rescue, Evacuation and Logistic Management, Psychological Response and Management (Trauma, Stress, Rumor and Panic) relief andb recovery medical health response to different disasters. Rehabilitation: Reconstruction and recovery, Reconstruction and rehabilitation as a means of development, dealing with victims' psychology, long term counter disaster planning role of educational institute. The vulnerability atlas of India, Disaster prevention and mitigation, Agencies involved in disaster management.
Note: (Basic concepts only and explanation can be done with discussing case studies)

Module III: (10 Hours)

Disaster profile of India – Mega disasters of India and lessons learnt disaster management act 2005 – Institutional and financial mechanism, National guidelines and plans on disaster management; Applications of science and technology for disaster management-geo-informatics in disaster management (RS, GIS, GPS and RS) Disaster Communication System (Early warning and its dissemination), Disaster safe designs and constructions, Structural and non-structural mitigation of disasters science &technology institutions for disaster management in India
Note: (Basic concepts only and explanation can be done with discussing case studies)

Module IV: (10 Hours)

First Aid, Basic life support and causality handling, Basics- Triage- CPR, Chocking, breathing difficulties, bleeding, burns, electric shock, animal bites, fractures, bandaging, splints and slings, Hazardous chemicals-Hazchem CODE, TREMCARD, Response in tanker lorry accidents.
Basics of Firefighting- Operation of fire extinguishers and fire protection systems in buildings. Transportation of causality-methods of rescue, two hand seat, three hand seat, four hand seat, human crutch, pick a back, fire man lift, improvised stretchers
Note: (Help of Medical professionals and staff from Fire and safety department/ safety professionals can be sought for giving proper practical training to the students in the specific topics mentioned in module 4. Students can also develop their own innovative devices/ methods to help the fire & safety dept. in rescue operations. After successful training in rescue operations the students can form a student volunteer group in each college to associate with the with the activities of Fire & Safety/NDRF officials to help the society during an emergency)

Module V: **(10 Hours)**

Flood Rescue, making of improvised floating aids, use of life buoy and life jacket, rope rescue, common rescue knots, chair knot, bow line etc.

Note: (Help of staff from Fire and safety department/safety professionals can be sought for giving practical training to the students in the specific topics mentioned in module 4. Students may come up with their ideas to develop innovative tools/techniques/methods/software's for helping various Govt. departments/Fire & safety/NDRF teams and society during the occurrence of any disasters)

COURSE OUTCOMES:

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

1. Understand the basics of risk and vulnerability analysis
2. Understand the basics concepts and types of disasters and accidents
3. Understand the basics of disaster preparedness and response
4. Understand the basics of disaster management Act and its features
5. Build skills and practice the basics of first aid and the usage of lifesaving equipment's
6. Develop skills and practice methods to save a life and respond during a flood disaster.

TEXT BOOKS:

1. S.C. Sharma, Disaster Management, 1 st edition, Khanna Publishing House, 2018
2. Ghosh G.K., Disaster Management, 1 st edition, APH Publishing Corporation,2006.
3. Singh B.K., Handbook of Disaster Management, 1 st edition, Rajat Publication, 2008.
4. A.K. Singh, Disaster Management in India, 1 st edition,New Royal Book Company, 2007.
5. D. Mondal, D. Basu, Disaster Management Concepts And Approach, CBS Publishers and Distributers, 2020.
6. R. Subramanian, Disaster Management, Vikas Publishing House, 2018.
7. M. M. Sulphy, Disaster Management, PHI Learning, 2017.

8. Satish Modh, Introduction to Disaster Management, Macmillan, 2009.

***REFERENCE BOOKS*:**

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
3. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
4. World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
5. Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
6. Encyclopedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
7. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
8. Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
10. Disaster Management Act 2005, Publisher by Govt. of India
11. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management (eg. Disaster Management for NDRF Commanders, Flood Risk Mitigation and Management, Village Disaster Management Plan etc)
12. NIDM Publications
13. High Power Committee Report, 2001, J.C. Pant
14. Disaster Mitigation in Asia & Pacific, Asian Development Bank
15. National Disaster Management Policy, 2009, GoI
16. Disaster Preparedness Kit, American Red Cross
17. Introduction to Incident Command System, First Edition, Centre for Disaster

Management, Lal Bhadur Sasthri National Academy of Administration.

EVALUATION SCHEME

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 607(P)	POST PRODUCTION LAB	L-T-P-C 0-0-3-1

PRE-REQUISITE: Post Production Technology

COURSE OBJECTIVES:

- To develop a basic knowledge in the post press operation of printing.
- To explain the Print finishing workflow.
- To illustrate the use of automatic and semi-automatic guillotine machine.
- To illustrate the case making process for hard bound books
- To illustrate the Operations and Mechanisms of various print finishing equipment's.
- To describe the role of Post production in Printing and Packaging industry.

SYLLABUS:

List of experiments:

(A minimum of 8 experiments must be conducted)

I. Study of the operations and mechanisms of the following machines:

a. Folding Machine. b. Guillotine Machine. c. Cutter and Greaser. d. Varnishing Machine. e. Laminating Machine. f. Sewing and Stitching Machine.

II. Preparation of :-

a) Saddle/side stitched Booklets.

b) Saddle sewing of Booklets, magazines.

c) Receipt Book of 25 receipt in triplicate.

d) Quarter Bound Note Book – flush sewing.

e) Quarter Bound A/c books sewing on tapes.

III. Preparation of the following types of bindings:

a. Half Bound Account Books b.Full Bound Books. c. Perfect Binding. d. Loose-Leaf Binding.

IV. Preparation of:

a) Court case file, b) Tag binder, c) Portfolio, d) Loose leaf book, e) Cheque book,

g) Preparing of old books.

V. Print finishing operation – Gold blocking, embossing, edge decoration.

COURSE OUTCOMES:

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

1. Outline and discuss the print finishing workflow
2. Examine and operate automatic and semi-automatic guillotine machines
3. Plan the sequences suitable for various types of securing operations
4. Design and construct hard case for book binding
5. Examine and operate various print finishing machineries

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern **(Maximum Marks-100)**

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

20% - Viva voce

10% - Fair record

PT19 608(P)	SCREEN PRINTING & FLEXOGRAPHY LAB	L-T-P-C 0-0-3-1

PRE-REQUISITE: Screen Printing and Gravure

COURSE OBJECTIVES:

- To study the Screen-Printing process and Flexographic printing.
- To describe the role of Screen Printing and Flexography in Printing and Packaging Industry.

SYLLABUS:

List of Experiments

(A minimum of 8 experiments must be conducted)

Screen Printing:

1. Familiarization of various Screen-Printing Materials.
2. Preparation of Fabric Stretching.
3. Preparation of Stencil.
   a) Direct Method
   b) Indirect Method
   c) Capillary Method
4. Screen Printing – Printing of Letterheads and Visiting Cards.
5. Screen Reclamation

Flexographic Printing:

1. Study of Stereos plates and Polymer Plates.
2. Study of Flexographic Machine Operations.

COURSE OUTCOMES:

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

1. Identify the various printing materials used in Screen-Printing.
2. Handle the fabric selection and stencil preparation for screen printing.
3. Print the image or text via screen printing.

4. Identify the flexographic printing plate.
5. Operate the flexographic printing machines.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50**)

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern **(Maximum Marks-100)**

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

20% - Viva voce

10% - Fair record

PT19 701	TONE AND COLOR ANALYSIS	L-T-P-C 3-1-0-3

PRE-REQUISITE: Concepts of Printing Technology

COURSE OBJECTIVES:

This paper deals about the concept of tone and the role of color management in printing. Also, this paper deals with various concepts of colour science, colour perception & measurement.

SYLLABUS:

Module I **(12 Hours)**

CIE- Spectral reflectance, CIE color standard, standard observer, tristimulus values Munsell-Munsell Hue circle, CIELAB, CIELUV, metamerism, Memory color, color management-Introduction- WYSWYG- functions of color management, color management module, Color engine, functions of CMM, Principle of color management, models of color management, RGB, HSB,ICC-Colorimeter and spectrophotometer, color calibration.

Module II **(12 Hours)**

Introduction, development of electronic publishing, basic elements of scanners, principles of electronic scanning , basic of electronic scanning, pixels-binary resolution, AM, FM Screening, digital halftones, basic scanner types-pantone-focal tone- trumatch- special/spot color- application of special color- digital images- sampled images-bitmap- raster- vector graphics. Scanning-automated scanning software, copy dot scanning and rescreening. Image capture elements- photomultiplier tubes, charged coupled device. Scanner adjustments, Scanner workflow, scanner resolution, scanner choice, preparing originals for scanning, types of scanners, working and their advantages. Tone adjustments- White, black point adjustments, gradation, color adjustments, automatic scanners adjustments, color separation.

Module III **(8 Hours)**

Types of originals, transparencies, the ideal transparencies, color correction, need for color correction, Masking, Integral color masking, color printing using standard inks, digital color separation, ink color sequence, brief intro to manual retouching.

Module IV **(8 Hours)**

Masking for color correction, types of masking, positive masking, negative masking, double overlay masking, integral color masking, dye retouching, -chemical correction or reduction, positive dot etching, intensification, unsharp masking, grey balance and tone reproduction.

Module V **(12 Hours)**

Densitometry, type of densities, specular, diffuse, double diffuse density, color printing, factors in color printing, printed color density, trapping, tone value, additivity and proportionality failure, UCR- GCR, color control strips and punch register system, duo ones- dot area measurement, Murray Davis equation and Yule nelson correction.

COURSE OUTCOMES: -

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

1. Represent colour using different colour models
2. Explain the principle of colour reproduction, evaluate colour originals and choose appropriate reproduction objective.
3. Infer the influence of substrate and ink properties on colour reproduction.
4. Implement suitable method to control colour in press.
5. Calculate the colour difference from the printed samples.

TEXT BOOKS:

1. Principles of color reproduction- J.A.C. Yale
2. Color – Robin B. McAllister
3. Gary Field, "Colour and its Reproduction", 3rd edition, GATF Press, 2004

REFERENCES BOOKS:

1. Phil Green, "Understanding Digital Colour", 2nd edition, GATF Press, 1999.
2. R. W. G. Hunt, "The Reproduction of Colour", 6th Edition, Wiley, 2004

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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 **5x10marks=50 marks**.

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

PT19 702	QUALITY CONTROL AND STANDARDIZATION	L-T-P-C 4-0-0-3

PRE-REQUISITE: Nil

***COURSE OBJECTIVE*:**

This paper gives knowledge about the quality control aids and importance of testing in Printing Industry.

SYLLABUS:

Module I **(11 hours)**

Introduction-Definition of quality, Quality control, its meaning and purpose. Setting up a quality control programme and establishing necessary procedures, economic consideration. Management responsibility. Quality systems and ISO 9000. Materials control-Establishing clear specifications and standardization of materials to be purchased. Inspection and testing of incoming materials as part of quality control, importance of proper handling and maintenance of records of performance of materials, Sampling.

Module II **(11 hours)**

Print characteristic definition, Print characteristic attributes-substrate, primary colour hue, secondary and tertiary colour hues, tone transfer, grey balance. Print characteristic specification. Measurement of the print characteristic. Print control strips-position of control strip on sheet, Ink colour and film thickness elements, trapping elements, Grey balance elements, Register targets. Tone transfer control elements (plate making)-continuous tone step wedge, micro lines, highlight and shadow dots. Tone transfer control elements(printing)-star target, variable dot size elements, coarse and fine screen halftones, tone patches for density measurement. Slur and doubling elements-star target, concentric circles, line tint areas.

Module III **(11hours)**

Requirement of quality control devices, Functions, Classifications – Diagnostic quality control devices, Process control devices, Standardization control devices. GATF Test Form-Introduction, Purposes of the Test Form, Targets for Evaluation, Information Block, Line Resolution Target, GATF/Systems of Merritt Digital Plate Control Target, Digital Ladder Targets, Image Fit Target, Mottle Patches, Gray Balance Chart, Three-Color Gray Bars, Digital Proof Comparator, Transfer Grids, Color Correction Target, Ink Coverage Target, Twenty-step Tone Scales and Vignettes, Dot Size Comparator, Single-Tier Control Bar, Six-Color Two-Tiered Control Bar, IT 8.7/3 Basic Data Set, GATF/RHEM Light Indicator.

Module IV **(11 hours)**

Quality control instrumentation-,Process control instruments,. Press sheet control devices for color printing. Minimum instrumentation necessary to produce a product consistent with the appropriate quality level. Control charts, attributes vs. variables. Different types of control charts-monitoring variables: the x-bar/R chart, monitoring print attributes, p chart, examples of p chart, c chart, examples of c chart.

Module-V **(8 Hours)**

Principles of print standards, Types of Standards such as ISO/PSO, TAPPI, CGATS, CIE, ICC, Media Standard, DIN, ASTM, ANSI developing of quality monitoring checklists for all processes, checklists of definable and measurable attributes of products.

COURSE OUTCOMES:

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

1. Implement ISO standards in prepress
2. Apply statistical process control tools and quality standards
3. Evaluate quality of incoming materials and outgoing products
4. Identify instruments required for implementing quality
5. Analyze the Print standards and establish process control checklist

TEXT BOOKS:

1. Miles Southworth and Donna Southworth. Quality and Productivity in the Graphic Arts Publishing Company (1980)
2. Douglas C. Montgomery, Introduction to Statistical Quality Control, John Wiley(1985)
3. Brian Rothery, ISO 9000, Productivity and Quality Publishing Private Ltd
4. Kelvin Tritton, Colour Control for Lithography, PIRA International.
5. Mortimer, A Colour Reproduction in Printing Industry PIRA International.

REFERENCE BOOKS:

1. Ken Holmes, Implementing ISO 9000, 2nd edition, PIRA International, 1995
2. Phil Green Quality Control for Print Buyers, Blue Print
3. J.P Casey (Ed) Pulp and Paper Chemistry and Chemical Technology, Vol II Wiley inter science.
4. Ronald E. Todd, Printing Inks – Formulation Principles, Manufacture and Quality Control Testing Procedures. PIRA International.
5. H.L Apfelberg and M.J. Apfelberg, Implementing Quality Management in Graphic Arts,GATF.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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**.**

5x10marks=50 marks.

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

PT19 703	PRINT PLANT LAYOUT & FACILITY DESIGN	L-T-P-C 3-0-1-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

This subject is mainly aim to study about design and layout for printing press and the various heavy duty material handling for printing.

SYLLABUS:

Module-I **(12 Hours)**

Objectives of good plant layout, principles of plant layout, importance of plant layout, Types of plant layout -product layout or live layout -process layout or functional layout-combination layout -static layout or fixed position layout, situations problem, factors influencing plant layout, Symptoms of bad layout. Flow pattern-line flow, L-type flow, circular flow, U-type flow, S or inverted S combination of U and line flow pattern. Characteristics and applications.

Module-II **(10 Hours)**

Printing press layout- Determining plant requirement site planning, new facility designing. Layout essentials- Direct product flow, Physical separation expansion. Importance of material movement. Few suggested design for hypothetical cases. Approachability of machines for service etc. Availability of service such as water, drainage, electric supply etc. Fundamentals of Foundation design. Vibration free mounting requirements. Variations of foundations General guidelines Structural requirements of foundations.

Module-III **(10 Hours)**

Ware house and storage of materials - Receiving shipping, waste paper, & trash removal, maintenance, flammable solvent storage, ink mixing , storage and pumping. Typical settings to be done on a sheet- fed and web press machine. Facility specification- Prepress area, Sheet fed press room, web offset press room, roll paper storage area, bindery, finishing.

Module-IV **(10 Hours)**

Materials control-Establishing clear specifications and standardization of materials to be purchased. Inspection and testing of incoming materials as part of quality control, importance of proper handling and maintenance of records of performance of materials, Sampling.

Module-V **(12 Hours)**

Different types of elevators and lowers handling materials in bulk and for large objects. Worm push plate, push through and belt conveyors: inking belts steel plate and slat conveyors; vibrating through conveyors. Automatic feeding devices for elevators and conveyers. Gravity chutes roller runways; live rollers humper stacker and gadgets. Fork trucks and pallets, Automatic handling of papers and printing machines, handling of printing rolls in printing machines and their automatic feeding. Conveyor system in finished printing products and automatic counters. Control of paper handling.

CORSE OUTCOMES:

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

1. Study the basic principles to be considered for designing a plant layout.
2. Understand the basic requirements for printing plant layout.
3. Acquire knowledge on facility specification based on the requirements.
4. Know about Quality control and handling of materials in a printing plant.
5. Aware about different equipment's used in plant.

***TEXT BOOKS*:**

1. Printing Plant & Facility Design- GATF
2. Material Handling for the printer – GATF

***REFERENCE BOOKS*:**

1. Francis R.L. and White J.A. (2000)"Facility layout and location" GATF, USA
2. Khanna O.P. (1996) "Industrial Engineering AND Management" Dhanpath rai and Sons, New Delhi.

EVALUATION SCHEME:

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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

5x10 marks=50 marks.

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

PT19 704	PRINTING MACHINERY AND MAINTANANCE	L-T-P-C 3-0-1-4

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

Machinery maintenance has a major role in printing industry. This paper provides a basic knowledge about different types of maintenance activities in mechanical, electrical and pneumatic systems.

SYLLABUS:

Module I **(10 hours)**

Maintenance management: - Objective of maintenance management, Maintenance functions.
Types of maintenance activities, maintenance planning, scheduling and control, maintenance records, contract maintenance. Training of maintenance staff, Human factor in maintenance. Reconditioning: -Principles of reconditioning-repair methods of various parts.
Modern trends: - Application of computers in maintenance.

Module II **(10 hours)**

Prepress Press and Post press maintenance- Pre press production rooms, Plate setters, Plate processors, Image-setters, Computers, Pre press bottlenecks, test run and Diagnostic study, Maintenance of rollers, blankets and dampening systems. Bindery and finishing maintenance.
Equipment needed for erection – selection of location and environmental conditions- erection procedure for various machines - loading and transport machines.

Module III **(10 hours)**

Lubrication and lubricants- Purpose of lubrications- types of lubricants, Additives used in lubricants, lubricating instructions for machine operators- replacement of lubricants- lubrication chart- annual lubrications. Replacement schedule- paint marks for lubricating points on the machines- regeneration of used oils.

Module IV **(10 hours)**

Maintenance of Pneumatic systems:-Compressors- reciprocating and rotary , Compressor accessories, valves for pneumatic systems. Compressed air systems- Centralized and decentralized. Maintenance of electrical systems- AC motors and DC motors. Electromagnets- magnetic starters and contractors- limit switches- knife switches- micro switches. electric panels- electrical apparatus

Module V **(12 hours)**

Maintenance of mechanical drives :-Chain and Sprockets: Types-roller, silent, block, bead, plain sprockets, Advantages and Disadvantages of chain and sprockets, role of chain in printing machine.
Belts: -classification, Type of joints, Maintenance of belts, Belt slippage. Pulleys- flat belt, v-belt, v-ribbed, timing belt. Advantages and disadvantages of belt drives.
Bearings:-Selection, types: Antifriction bearings- Ball, Radial roller and Needle bearing. Porous bearing, Oil less bearing, Advantages of bearings, Baring failure.
Gears : Types , advantages and disadvantages ,maintenance of gears

***COURSE OUTCOMES*:**

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

1. Know about different types of maintenance activities
2. Identify about machinery maintenance and its control.
3. Acquire knowledge about mechanical drive maintenance.
4. Know about electrical system maintenance.
5. Explain about pneumatic system maintenance.

TEXT BOOKS:

1. Lithographers manual, Graphical arts Technology Foundation, USA.
2. Herschel L.Apfelberg, Maintaining printing equipment, GATF
3. Barbara, L.Albinini and others, Solving web offset press problems, GATF

REFERENCE BOOKS:

1. H.P. Garg, Industrial maintenance, S. Chand & Company ltd.
2. Lewis and Tow, Readings in maintenance management, Cohners Books.
3. A.S Porter, A manual of Lithographic press operation, Lithographic trading services.
4. Pamela Groff and others, Lithographic Press operators Handbook

EVALUATION SCHEME:

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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

5x10 marks=50 marks.

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

PT19 705(A)	ADVERTISING MANAGEMENT	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

Advertising Management has playing a vital role in the Printing and media industry. This subject discusses about advertising production and business in detail.

SYLLABUS:

Module I **(12 hours)**

Introduction - Advertising concept, development and scope of advertising, economic and Social roles of advertising, legal aspects of advertising, major institutions Involved in advertising. Meaning of consumer behaviour. How marketing firms use consumer behavior, characteristics of advertising communications, achieving desired responses, stimulating attention and facilitating retention, human needs as a basis for appeals. Role of printing presses in advertising.

Module II **(10 hours)**

Advertising planning **-** Factors involved in advertising planning decision making, basis for advertising Objectives, Methods of Measuring Advertising Effectiveness, Dagmar model. Copywriting- meaning and definition of copywriting, the copywriter, copywriting for print, copywriting guidelines, radio copywriting, TV copywriting, writing for the web, tips for writing good web content.

Module III **(10 hours)**

Advertising media and media planning **-** Media concept, structure of media, media characteristics, publication media, TV and Ratio, direct mail and POP, out of home advertising. Media planning concept, media decision tools, media plan, media plan strategy, media buying and scheduling. Internet and Mobile Phone Advertising.

Module IV **(10 hours)**

Advertising production - Copy concept, copy structure, essentials of a copy, creative approaches and styles, copy testing criteria, types of copy testing, validity and reliability of copy test. Advertising design, layout, visualization, principles of advertising design, contribution of visual elements, what to picture, how to choose colour, test of a good layout, production of print advertising, production of TV/Radio commercials.

Module V **(10 hours)**

Advertising business and coordination **-** Historical development, advertising agencies, special service groups. Coordination with personal selling and distribution channels, cooperative advertising and public relation, advertising and product management. Advertising campaign concept, planning and execution of campaign, evaluation of the campaign.

COURSE OUTCOMES:

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

1. State the concepts and the importance of advertising.
2. Analyse the planning aspects of advertising.
3. Explain the functioning of advertising in the various media
4. Discuss various advertising production methods.
5. Develop advertising campaigns.

TEXT BOOKS:

1. David A.Aaker, Rajeev Batra, John G.Myers, “Advertising Management”, Prentice Hall Inc., 1999.
2. Maurice I.Mandell, “Advertising”, Prentice Hall Inc., 1999

REFERENCE BOOKS:

1. Leon G.Schiffman and Leslie Lajar Konar, “Consumer Behaviour”, Prentice Hall Inc., 1996.
2. Loudon, Della Bitta, “Consumer Behaviour concepts and Application”, McGraw Hill, 1996.
3. Wells, Burnett and Moriarty, “Advertising; Principles & Practice”, Prentice Hall Inc., 2002

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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

5x10 marks=50 marks.

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

PT19 705(B)	DIGITAL PHOTOGRAPHY	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

This subject discusses about the basic concepts of photography &camera controls and also deals with Photographic processing methods & Digital Imaging.

SYLLABUS:

Module-I **(6 Hours)**

Introduction: Brief history and development of photography, famous photographers, photography as an art form, symbolism, realism, surrealism and expressionism in photography, types of photography.

Module-II **(15 Hours)**

Imaging Systems: The production of images. Photographic & Digital Imaging. General characteristics of reproduction systems. Imaging chains. Reproduction of tone and color. Image quality expectations. Fundamentals of light & vision.

Photographic light sources: characteristics. Light outputs- units, illumination law, Reflectors & luminaries-constancy of output – efficiency-operation & maintenance. Types of lamps, flash bulb. Types of camera, special purpose cameras, Automatic camera, Digital cameras-principle, features & function.

Module-II **(12 Hours)**

Camera features: Shutter system, Iris diaphragm, View finders- types & function. Flash Synchronization. Focusing systems. Autos focus systems. Exposure metering systems. Battery Power. Data Imprinting.

Camera movements: Transitional & Rotational. Lens covering power. Control of image sharpness. Limits to lens tilt. Control of image shape.

Module-IV **(12 Hours)**

Sensitive materials & Image Sensors: Latent image formation. Image formation by charge coupled devices. Production of light sensitive materials and sensors. Coating the photographic emulsion. CCD. Size and formats of photographic & electronic sensors and media. Film coating. Spectral sensitivity of photographic materials: Types, Response to short wave radiation & visible radiation. Spectral sensitization. Determination of color sensitivity. Spectral sensitivity of digital camera. Principle of color photography. Reproduction of color.

Module-V **(7 Hours)**

Photographic processing: Developers & development, Replenishment. Techniques of development, fixing, washing, drying.

Hard copy output media: Photographic papers, types of silver halide emulsion, Color photographic papers- processing & development techniques. Digital output.

COURSE OUTCOMES:

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

1. Know about the basic concepts of photography &camera controls.
2. Explain details digital photography
3. Acquire knowledge about image sensors
4. Know about the photographic processing methods & Digital Imaging.
5. Identify the difference between different camera technology

TEXT BOOK:

1. Ralph E Jacobson, Sidney Fray , Geoffreyy A Attridge, Norman R Axford. The manual of photography Photography & digital imaging: 9th ed,

REFERENCE BOOKS:

1. Barbara London, John Upton, KenKobre, Betsy Brill ,Photography 7 th ed, Prentice Hall.
2. George H Wallace, Chuck Gloman Digital Photography Solutions,

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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

5x10 marks=50 marks.

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

PT19 705 (C)	PACKAGING SCIENCE	L-T-P-C 3-1-0-3

PRE-REQUISITE: Packaging Technology

COURSE OBJECTIVES:

This subject deals with the detailed study of Packaging and its allied industries. Also imparts a comprehensive study about environmental concerns in the Printing and Packaging industry.

SYLLABUS:

Module I **(8 hours)**

Introduction to package-Functions and applications of Package, packaging marks, package design considerations for package design. Folding Carton parts-trends in packaging- testing of material for printing and packaging – Bursting strength, puncture resistance, grammage, drop test, mechanical test tensile strength, modulus of elasticity, Flexural test optical test, chemical test.

Module II **(8 hours)**

Flexible Packaging-Characteristics-pouch styles, pillow pouches, three side seal pouches, Four side seal pouches, stand- up pouches-forming pouches, retort pouches -bulk and heavy duty bags-bag in box. Bar coding-Barcode structures. Types-verifying/analysing, printed barcodes. UPC and flexo printing, UPC film masters & printing capability test. SCS Shipping contain barcode printing.

Module III **(10 hours)**

Role of plastic in packaging, thermal properties-mechanical properties-barrier properties-surfaces and addition-optical characteristics-electrical characteristics-adhesion, adhesives-types-reactive, hot melt, solvent borne, water borne, pressure sensitive, re-moistenable, cold seal, UV and e-beam curing-Heat sealing-sealing methods-bar/thermal, impulse, band, hot wire/hot knife sealing, ultrasonic, friction, hot gas & contact, radiant, dielectric , magnetic, induction, solvent sealing.

Module IV **(11 hours)**

Food Packaging, Developments in food processing & packaging, Introduction to food packaging technology. Future trends in food packaging- Anti- microbial packaging systems-food safety antimicrobial packaging –Antimicrobial agents. Antimicrobial mechanisms- Technical factor for antimicrobial system. Oxygen scavenging packaging- package inserts-Intelligent packaging- Applications and technologies- Freshness and microbial indicator, Time temperature indicator, gas concentrator indicator

Module V **(15 hours)**

Packaging of Cosmetics: Factors effecting shelf life, cosmetic packaging materials - soda glass, sulphated glass, neutral glass, borosilicate glass, plastics used in cosmetic industry - polystyrene, polyvinyl chloride, aerosol packaging, recent developments. Packaging of Fertilizers and Pesticides: Packaging materials, factors governing selection, types - jute bags, multiwall paper sacks, PVC, LDPE, HDPE, polypropylene woven sack, recent developments. Packaging of Pharmaceutical Products: Types**,** materials used and properties, surface treatments, blister, strip and sachet packaging, printing and decorating. Packaging of Hazardous Chemicals: Requisites for packaging materials, common packages for hazardous chemicals - textile bags, paper bags, metal containers, glass containers, paper board/fibre board containers, plastic containers, recent developments

COURSE OUTCOMES:

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

1. Know about packaging of cosmetics.
2. Comprehend the importance of packaging materials, testing & evaluation, bar coding, and environmental concerns.
3. Acquire about Flexible packaging.
4. Identify about packaging of fertilizers and pesticides.
5. Summarize the concepts of food, Pharma packaging.

TEXT BOOKS:

1. Innovations in food packaging (edited by Jung. H Han), Elsivier academic Press
2. Susan. E. M Selke, John D Culter, Ruben J Hernandez, Plastic Packaging (2E), Hanser Publishers, Meenich.

3. Davis, C.G, Introduction to Packaging Machinery, Packaging Machinery Manufacturers Institute, 1997.
4. Gordon L. Robertson, Food Packaging - Principles and Practices, Marcel Dekker, Inc, 2008.
5. Brody Aaron L, The Wiley Encyclopedia of Packaging Technology, John Wiley & Sons, Inc., 1997.

REFERENCE BOOK:

1. Arthur Hirsch, Flexible Food Packaging, Van Nostor and Reinhold, New York, 1991.
2. Aaron L. Brody & Kenneth S. Marsh, Encyclopedia of Packaging Technology, John Wiley Inter science Publication, II Edition,1997.
3. Paine, Packaging Development, PIRA International,1990.
4. Walter Stern, Handbook of Package Design Research, Wiley Interscience,1981.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50**)

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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

5x10 marks=50 marks.

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

PT19 705 (D)	GREEN PRINTING	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES: This subject aims

1. To impart knowledge on sustainable green printing polices
2. To introduce the best practices for green printing manufacturing
3. To introduce lean manufacturing practices

SYLLABUS:

Module I **(12 Hours)**

Green Printing: Introduction. Environment: Overview and requirements, Pollution Prevention and Cleaner Production - Drivers, barriers, benefits of P2 and CP. P2 / CP program elements, P2 /CP strategies. Waste Handling: Waste generated from Pre-press, press and post-press departments, Specific wastes from different printing processes - their sources and control, Waste segregation, recycling and reuse - paper, ink, solvents and other materials, Carbon footprint.

Module II **(8 Hours)**

Alternative Materials: Paper, ink, solvents, adhesives and other materials, Printing with less alcohol, Eco friendly Accessories.

Module III **(12 Hours)**

Sustainability: Process Modifications, Mechanical modifications and press controls. Digital Processes, Speed-master SM 52, Clean Star, Exhaust air cleaning, Wash Star - Reusing wash up solution, Eco Clean - Washup solution filtration, Eco friendly Ink cartridge & Ink Line.

Module IV **(8 Hours)**

Material Handling and Storage: Equipment, storage conditions and material control, Printing Ink - its impact on environment, dampening solution and press environment, Reducing VOC emissions from press cleaning solvents.

Module V **(12 Hours)**

Recycling, possibilities in industry. Case studies, Environmental Management System: Environmental accounting concepts, data collection, evaluation and process operations, ISO 14000 and Life-cycle concepts.

COURSE OUTCOMES:

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

1. Identify the best practices for green printing manufacturing in industries.
2. Describe the various policies for green printing manufacturing.
3. Implement lean principles to reduce industrial wastes.
4. Know basics about green printing methods.
5. Acquire knowledge about recycling methods.

TEXTBOOKS:

1. Kipphan Helmut, Handbook of Print Media, Springer, 2001.
2. Jones Gary A, Air Pollution Engineering Guide for Graphic Arts Industry, GATF, 1993.
3. F.F.T.A., Flexography: Principles and Practices, Foundation of Flexographic Technical Association Inc., 1999.

REFERENCE BOOKS:

1. John Geis A and Paul Addy L., Materials Handling for the Printer, GATF Press, 1999.
2. Kenneth Mulholland L and James Dyer, Pollution Prevention: Methodology, Technologies and Practices, American Institute of Chemical Engineers, 1999.
3. Juergen Baro, et al., UV Technology: A practical guide for all Printing Processes, BG, Wiesbaden, 2008.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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

5x10 marks=50 marks.

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

PT19 705 (E)	COLOUR MANAGEMENT SYSTEM	L-T-P-C 3-1-0-3

***PRE-REQUISITE*:** Tone and Color Analysis

COURSE OBJECTIVES:

- To learn the fundamentals of colour management system.
- To understand the device variables and procedure for device characterization.
- To comprehend issues in colour conversion.
- To familiarize about press standardization.
- To gain knowledge about colour management workflows

SYLLABUS:

Module-I **(10 Hours)**

Need for colour management, Device characteristics, Closed and Open loop colour control, international colour consortium – standards, profiles, profile types; Colour Management - Components, steps, workflow; Colour tolerances – dE, dE00, dE CMC, weighting factors; Colour measurement devices - types, calibration, accuracy, sampling size, sample type (textile/metallics/pearlescent/translucent), measurement condition; Standards – ISO, ASTM, DIN.

Module-II **(11 Hours)**

Profile structure, Lookup table construction, Profile Connection Space, Test targets, Profiling software; Device characterization methods-Numerical, LUT; Calibration and characterization of display, scanner, digital camera, cell phone/tablets, press and proofer; Profile quality evaluation; Profile editing.

Module-III **(10 Hours)**

CMM - functions, static, dynamic; Gamut boundaries, Gamut mapping – influencing factors, algorithms, Rendering Intent, ICC limitations - Effect of optical brighteners, Black point compensation, Black channel preservation, Optimization of colour transforms; Device link profiles, Colour servers, Colour Appearance Models; ICCMax – spectral transform, BRDF, calculator transform; Brand/Spot colour matching – gamut limitations, substrate considerations.

Module-IV **(10 Hours)**

Variables in printing process, Test forms, Press standardization, Optimization - Gravure, Flexography, Offset, Screen, Digital; ISO standards; Press Certifications – G7, PSO, Japan Colour, FOGRA; Colour conformance software.

Module-V **(11 Hours)**

Colour features and Settings – Operating system, Prepress software, Press (RIP), Print driver; Colour profiles – Input, Output, Simulation; Standard colour spaces – Adobe RGB, USSWOP, GRACoL, Fogra; Embedded profiles; Grayscale profile; Soft Proofing, Digital proofing, Spot colour workflow and colour matching; Colour Vision tests; Production workflows - Data format, Configurations, Colour conversions; Internet workflow, Colour Science in other fields (textile, food, astronomy, medical, cosmetics), Case studies.

COURSE OUTCOMES:

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

1. Infer the steps in implementing colour management system and choose suitable device configuration for colour measurement following quality standards.
2. Create profiles for display, input and output devices.
3. Explain the gamut mapping concepts by applying boundary constraints.
4. Design methodology to standardize the various printing processes as per ISO standards.
5. Reproduce and match colour across various devices and software applications.

TEXT BOOKS:

1. Abhay Sharma, Understanding Colour Management, Thomson Delmar, 2004.
2. Phil Green, Michael Kriss, Colour Management: Understanding and Using ICC profiles, The Wiley-IS&T Series in Imaging Science and Technology, 2010.

REFERENCE BOOKS:

1. Adams R.M. & Weisberg J.B., GATF Practical Guide to Colour Management, 2nd. Ed., GATF Press, 2000
2. Bruce Fraser, Chris Murphy, & Fred Bunting, Real World Colour Management, 2nd Edition, Peachpit Press

3. Mark D. Fairchild, Colour Appearance Models, Second Edition, John Wiley & Sons Ltd., 2005
4. Phil Green, Lindsay MacDonald, Colour Engineering, John Wiley & Sons Ltd., 2002

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home-work, 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

5x10 marks=50 marks.

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

PT19 705 (F)	TOTAL QUALITY MANAGEMENT(TQM)	L-T-P-C 3-1-0-3

***PRE-REQUISITE*:** Nil

COURSE OBJECTIVES:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

SYLLABUS:

Module-I **(10 Hours)**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM —Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

Module II **(12 Hours)**

TQM Principles

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

Module III **(10 Hours)**

TQM Tools & Techniques I

The seven traditional tools of quality - New management tools - Six-sigma Process Capability-

Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA – Intent, Documentation, Stages: Design FMEA and Process FMEA.

Module IV **(10 Hours)**

TQM Tools & Techniques II

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

Module V **(10 Hours)**

Quality Management System:- Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation-InternalAudits-Registration- ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

1. Study TQM concepts in a selected enterprise
2. Apply TQM principles in a selected enterprise.
3. Understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
4. Understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
5. Know about QMS and EMS in any organization.

***TEXT BOOKS*:**

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCE BOOKS:

1. Joel.E. Ross, "Total Quality Management – Text and Cases",Routledge.,2017.
2. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
3. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
4. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, 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

5x10 marks=50 marks.

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

PT19 706 (P)	TONE AND COLOR ANALYSIS LAB	L-T-P-C 0-0-3-1

***PRE-REQUISITE*:** Tone and Color Analysis

COURSE OBJECTIVES:

1. To impart a basic knowledge about color and its measuring instruments.
2. To understand the influence of device settings in image acquisition and learn the tonal and colour adjustments
3. To understand colour management options in various stages of prepress workflow

SYLLABUS:

List of Experiments

(A minimum of 8 experiments must be conducted)

1. Familiarizing with half tone & continuous tone copy.
2. Familiarizing with color management softwares.
3. Color measurements by using i. Spectrophotometer. ii. Colorimeter. iii. Densitometer.
4. Calibration of devices-Scanner, Printer, Monitor.
5. Dot area measurement by using dot area meter.
6. Dot area measurement by using Murray Davis Equation.
7. Dot area measurement by using Nauebauger equation.
8. Familiarizing of quality control aids
    i. Color control charts
    ii. Fogra Charts.
    iii. GATF Charts.

COURSE OUTCOMES:

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

1. Perform image acquisition, colour correction and image analysis.
2. Create profiles for various devices.
3. Evaluate quality of proof and print for given quality standards.
4. Perform colour conversion for different colour reproduction objectives.
5. Customize software and RIP settings for given press parameters.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern **(Maximum Marks-100*)***

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

20% - Viva voce

10% - Fair record

PT19 707 (P)	QUALITY CONTROL LAB	L-T-P-C 0-0-3-1

PRE-REQUISITE: Quality control and standardization

COURSE OBJECTIVES:

1. To understand the testing and quality control of printing and packaging materials.
2. To have hands on training in Instrumentation handling and testing
3. To learn about performance properties of package materials

SYLLABUS:

List of Experiments

(A minimum of 8 experiments must be conducted)

1. Measuring the GSM of Paper and Paper board.
2. Curl test
3. Moisture content of paper
4. Measuring the tensile strength of Paper
5. Measuring the Bursting strength of paper
6. Measuring the folding endurance of paper
7. Measuring the Brightness and Gloss of Paper
8. Measuring the Opacity and RGB reflectance of Paper
9. Ink testing

   a. Flow property b. Length c. Ink-water emulsification
10. Measuring the drying time of Ink
11. Measuring the Paper pH
12. Measuring the pH of Fountain solution

COURSE OUTCOMES:

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

1. Operate the quality control and testing equipment's
2. Standardize the quality and performance of printing and packaging materials.

3. Create the standard working procedure for testing of packaging materials.
4. Implement various standards like ISO, TAPPI, ASTM and IS in testing.
5. Identify samples and sampling method for package testing.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern **(Maximum Marks-100*)***

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

20% - Viva voce

10% - Fair record

PT19 708 (P)	PROJECT PHASE-I	L-T-P-C 0-0-4-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To enable the students to apply the engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.

SYLLABUS:

Project work is for duration of two semesters and is expected to be completed in the eighth semester. 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. Each student group consisting of not more than four members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. Project evaluation committee consisting of the HOD or a senior faculty member, guide and three/four faculty members specialized in the above field shall perform the screening and evaluation of the projects.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent. Literature survey and 40% of the work has to be completed in the seventh semester.

Students should execute the project work using the facilities of the institute. However, external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

Each student has to submit an interim report of the project at the end of the 7^{th} semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7^{th} semester.

PT19 709 (P)	INTERNSHIP	L-T-P-C 0-0-0-1

COURSE OUTCOMES:

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

- Identify a topic of interest and use acquired knowledge within the selected area of technology for project development.
- Discuss and justify the technical aspects and design aspects of the project with a systematic approach.
- Analyze the technical aspects and design aspects of the project and propose a work plan.
- Practice team dynamics to work effectively in a team for the development of technical projects.
- Develop skills in technical presentation and report preparation.

Assessment Pattern

The Evaluation will be conducted as an internal evaluation based on the work done, the report and a viva- voce examination, conducted by a Project evaluation committee appointed by Head of the Department. The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systems under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest /problem domain or conduct open brain storming sessions for developing innovative ideas. Zeroth review will not be a part of the evaluation process.

Internal Continuous Assessment (Maximum Marks-100, Minimum required to pass-50)

30% - Project Guide

20% - Interim evaluation by the evaluation committee

30% - Final presentation

20% - Report evaluation by the evaluation committee

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To become acquainted with the future field of the Printing Technology.
- To apply the acquired knowledge and skills in a practical situation.
- To become acquainted with real life problem solving.

SYLLABUS:

Students need to undergo a minimum of 10-15 days internship in an Industry/Firm associated with conventional and modern printing technology to observe, identify and give suggestions to the problems related to printing or allied engineering sector in the society. The Internship should give exposure to the practical aspects of the relevant course/branch and allied engineering discipline. 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/systems 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.

COURSE OUTCOMES:

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

- Identify how the internship relates to their academic courses and preferred career path.
- Communicate in a workplace environment in a clear and confident manner.
- Evaluate performance and accept feedback, in order to make changes as necessary.
- Articulate their experience and skills to potential employers.
- Identify and articulate next steps in their career trajectory.

Internal Continuous Assessment **(Maximum Marks-100, Minimum required to pass-50)**

10% - Attendance

20% - Coordinator

30% - Technical content of the report

40% - Presentation

PT19 801	PRINT MANAGEMENT COSTING AND ESTIMATING	L-T-P-C 3-1-0-4

***PRE-REQUISITE*:** Nil

COURSE OBJECTIVES:

- To impart the concepts of costing and pricing in Printing and Packaging industry.
- To analyse the cost and pricing for the print finishing operations.

SYLLABUS:

Module I **(8 Hours)**

Printing management, Management principles, Management functions, Organizational criteria, Skills requirements, Types of business, Printing company management structures, Management team responsibilities, Business plan, Management styles, Management decisions, Communications, Print marketing and sales – marketing sales.

Module II **(10 Hours)**

HRM for printing, employment policy, evaluation of skills requirements for printing occupations, recruitment, job evaluation, staff appraisal, motivation training, human resources factors that limit productivity, staff flexibility. Single & double entry book keeping system. Objectives of bookkeeping. Meaning of journal, ledger, debit, credit, asset, liability & capital. Differences between journal and ledger. Formats of journal & ledger. Types of accounts. Journalizing rules, problems. Trial balance meaning & format. Format of balance sheet & income statement, contents to be explained.

Module III **(10 Hours)**

Cost accountancy & its subjects, relationship of cost & financial accounting, cost accounting &management accounting, costing as a basis for estimating, the purpose of cost accounting, advantages of cost accounting, installation of costing systems, costing system for printing industry & related problem. The concept of cost, Analysis of cost, elements of cost, Overheads – classification. Allocation & apportionment, Overhead absorption rates & problem.

Module IV **(14 Hours)**

The scope and function of printing estimating- introduction to cost estimating for printing, the interrelationship between cost estimating and other plant duties, What the estimator needs to know, General procedure for selling, estimating, and quoting printed work, The estimator's working environment, Qualifications of an estimator, Some rules for the working printing estimator. Purpose and functions of estimating from printer point of view & customer's point of view. Difference between costing & estimating. Printing orders from sales through invoice - selling the Print order, customer service representatives, preparing job specifications and request for estimate, the cost estimate based on job specifications. Production standards and budgeted hour cost rates in the printing industry.

Module V **(10 Hours)**

Estimating paper – selection of paper, allowance for waste, allowance for trimming, weight of loose sheets, equivalent weight of paper, weight of a reel of paper. Estimating ink – ink schedules, variables when estimating ink, cost of ink, ink quantity and cost estimation. Estimating binding materials – Board requirement, estimating covering materials, estimating sewing thread, estimating stitching wire, estimating adhesives. Estimating web lithographic production.

COURSE OUTCOMES:

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

1. Estimate the cost of different materials used in printing.
2. Identify the pricing, costing and budget system for printing.
3. Apply the concepts of costing technique in Press, prepress and post press.
4. Calculate the composite machine hour rate (CMHR) and budgeted hour rate (BHR) for the machines used in printing.
5. Do Investment analysis and breakeven analysis.

TEXTBOOKS:

1. Hugh Speirs, Print Estimator's Handbook, 2nd edition, Pira International Ltd., 2004
2. Printing and estimating principles and practices third edition by Phillip Kent Ruggles

3. Prasanna Chandra, Financial Management, Theory and Practice, Tata Mc GrawHill, NewDelhi,6thEd., 2004.
4. B.S. Raman, Principles of Accounting.

REFERENCE BOOK:

1. Cost Accounting for Printers, Part I and Part II, British Printing Industries Federation, 1982
2. Dipl.-Ing.B.D.Mendiratta, Printer's Costing and Estimating, Printing India Publications Pvt. Ltd. 1999.
3. Hugh M.Speirs, Print Estimators–The Handbook, BPIF, 1996.
4. K.S. Venkataraman and K.S. Balaraman, Estimating Methods and Cost Analysis for Printers, Ramya Features and Publications,1987

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 802	SECURITY PRINTING	L-T-P-C 4-0-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To identify and explain the security printing techniques.
- To discuss the need for security printing.
- To list and explain the types of security inks and substrates.
- To explain various security printing applications.

SYLLABUS:

Module I **(12 Hours)**

Security Printing: Introduction, **Security features**: **substrate**: Paper Substrate**-**Composition, Watermarks, Chemical reactants, Feel and Sound, Fluorescence-Security fibers, Planchets, Embedded thread, Windowed thread, Perforation. Plastic cards-Laser engraving, Card embedded features. Synthetic Papers-Shadow image-Blind embossing- Self authenticating features. Printing techniques.

Module II **(12 Hours)**

Printing inks: Photochromism, Luminescence, Bleed through security numbering. Thermochromic ink, Metameric inks, Fugitive inks, Iridescent ink, Magnetic ink, Photochromic ink, Invisible Phosphorescent inks, Biometric ink. Coin reactive ink.
Printed Security pattern: Guilloches, Microprinting, See through register, Engraved portraits, Transitory images, digitally watermarked images, Screen decoded images- Scrambled images.

Module-III **(8 Hours)**

Bar Coding: Types, Structure Characteristics- Symbology's – Barcode Readers and Scanners- Barcode Printers- Barcode numbering. Applications.
Currency Printing: History, Basic elements- Security features used in basic elements of note,

Materials used- Manufacturing process.

Module IV **(8 Hours)**

MICR: Introduction- Need and Requirement-MICR Characters: E-13B Font, CMC-7 Font**- -**. Paper specification, Pre-encoding and Post-Encoding-Tolerance data, Testing equipment, MICR documents**:** Print specification for MICR documents, Standards for MICR encoded Documents. Production consideration- Substrate properties, ink, Quality control and testing.

Module V **(12 Hours)**

Hologram: Introduction, Types, Manufacturing and recording process. **Cheque**: definition, specification for cheque paper, cheques generally contain, Basic design of a cheque-security features in Indian bank cheque, Print specification for Bank cheque- RBI specification -Principles of Cheque Design-General requirements. Paper specifications- **Security Labels**

COURSE OUTCOMES:

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

1. Explain the basic concepts of security printing.
2. Illustrate and classify the security inks.
3. Identify and utilize the advantages of security inks and substrates.
4. Develop security techniques as per the requirement.
5. Categorize and recommend suitable security printing technique for appropriate applications.

TEXT BOOKS:

1. Richard D. Warner, Richard M. Adams, "Introduction to Security Printing", PIA/GATF Press, 2005
2. Rudolf L.Van Renesse Optical Document Security 3rd edition Artech house.

REFERENCE BOOKS:

1. A.S. Bhaskar Raj, Barcode Technology and Implementation, McGraw Hill, 2007.
2. Developments in Security Labels and Tags, Rudie Lion, Pria International Ltd.
3. Martin Monestics, The Art of Paper Currency, Quarlet Books Ltd.,1983.

4. Martin Monestics, “The Art of Paper Currency”, Quarlet Books Ltd., 1983.
5. Leibinger, “Numbering Machines and Systems”, Leibinger Numbering Systems, 2000.
6. William H.Erdei, “Bar Codes – Design, Printing and Quality Control”, Mc Graw Hill

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 803 (A)	E- PUBLISHING	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- ✓ To understand the basics of Online Publishing concepts and avenues.
- ✓ To learn the importance of layout and design in areas of publishing
- ✓ To familiarize electronic publishing models and workflow software.
- ✓ To comprehend various software tools in designing e-publishing
- ✓ To design and launch website for online publishing

SYLLABUS:

Module I **(12 Hours)**

Introduction Electronic publishing. Cultural and social impact. Hybrid formats for books and magazines needing shelf-appeal. Readers adapt to the new media. Create your own books and other publications. Catering for minority interests and niches markets. Multimedia in perspective. Breaking the physical barriers of print. Limitless opportunities. Cooperative writing. Easy, economical publishing. Future trends. Turn your work into multimedia. Selecting authoring software. Multimedia hardware requirements. Adding pictures and sound the easy way. Adding sound is easy and economical. Musical opportunities. Morphing is a practical tool. Virtual reality as a publishing medium.

Module II **(10 Hours)**

Publishing & Publication Media: Definitions, Publishing and the production process, Standards, Publishers' and Metadata. Offline, Online and hybrid publication Media.

Content and Content Formats: Content types, text, Content formats - graphics, page facsimiles, structured data, audio, video and multimedia, Software.

E-publishing Models: E-books, print-on-demand, electronic ink, email publishing, web publishing.

E-book: E-book content, delivery formats, components, producing e-books, e-books and metadata, e-books and encryption, managing e-book content.

Module III **(10 Hours)**

Digital Library: Scope, uses, challenges, features, formats.

Digital Asset Management: Systems, functionality, infrastructure, types, and benefits.

Document Management System: Capture, indexing & retrieval, annotations, storage and archival, distribution and workflow.

Digital Rights Management: Aim, need, legal requirements, approach, challenges, limitations, applications, process.

Intellectual Property Rights and Copyrights: Issues, contracts, challenges and applications.

E-publishing formats: HTML, SGML, XML, PDF and Latex.

Module IV **(10 Hours)**

Softwares & Tools-Conventional workflow, XML workflow, STM Typesetting softwares, Pagination softwares, Image manipulation softwares, Markup languages – fundamentals, Presentation technologies (HTML, CSS, WML, XSL/XSL-FO), Representation technologies (XML, DTD, W3C XML Schema) Transformation technologies (SAX, DOM, XSLT), Scripting languages (ASP, JS, Perl), Unicode's for non-English characters.

Module V **(10 Hours)**

Production And Maintenance of Website- Digital Business models in Internet, Marketing, Future publishing Models, Recent trends in e-publishing; Design and Construction – Testing, Launch and Handover – Maintenance – Review and Evaluation and Scripts, Develop Portfolios in the Form of Web Pages which have to be uploaded in Free Public Domains.

COURSE OUTCOMES:

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

1. Summarize the avenues of electronic publishing
2. Develop and design layouts for various digital gadgets.
3. Distinguish the functions of various modules of a workflow software
4. Identify proper software for web presentation and transformation language.
5. Acquire knowledge about constructing and launching of website for publishing.

TEXT BOOKS:

1. Peter K. Ryan, Careers in Electronic Publishing, The Rosen Publishing Group, 2013
2. Robert Campbell, Ed Pentz,, Ian Borthwick, Academic and Professional Publishing, Elsevier, 2012

REFERENCE BOOKS:

1. Georg Peters and Jan Seruga, Cross Media and E-Publishing, Carina Rogobete, International Journal of u- and e- Service, Science and Technology Vol. 5, No. 2. 2012.
2. Archana Saxena, Electronic Publishing: Impact of ICT on Academic Libraries, ICAL. 2009.
3. Intellectual Property Rights Issues of Digital Publishing - Presence and Perspectives, Hamburg University, Scripted, Volume 2, Issue 2, 2005.
4. Digital Asset Management— A Closer Look at the Literature, A Research Monograph of the Printing Industry Center at RIT, 2005.
5. Wayne Overbeck and Genelle Belmas, Major Principles of Media Law, Wadsworth - Cengage Learning, 2010.
6. Thakurta and Paranjoy Guha, Media Ethics, Oxford University Press, 2009.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 803 (B)	ELECTRONIC PACKAGING	L-T-P-C 3-1-0-3

PRE-REQUISITE: **Nil**

COURSE OBJECTIVES:

- To impart knowledge on electronic packaging.
- To impart knowledge Technology drivers, Electrical performance and Thermal management.
- To impart knowledge on electronic packaging materials.
- To understand about RF integrations, Reliability, System issues, Assembly and Testing.

SYLLABUS:

Module I **(10 hours)**

Introduction – Role of packaging – IC packaging – MEMS packaging – Consumer Electronics packaging – Medical Electronics packaging – Trends, challenges. Electrical Design - Interconnect Capacitance, Resistance and Inductance fundamentals – Transmission Lines (basic concepts) - Clock Distribution - Noise Sources - Power Distribution – signal distribution – EMI - Digital and RF Issues

Module II **(10 hours)**

Thermal Management - Heat-transfer fundamentals - Thermal conductivity and resistance - Conduction, convection and radiation – Cooling requirements Reliability - Basic concepts - Environmental interactions - Thermal mismatch and fatigue – failures –thermo mechanically induced – electrically induces – chemically induced-

Module III **(10 hours)**

Single chip packaging – functions, types, materials processes, properties, characteristics, trends Multi chip packaging – types, design, comparison, trends IC assembly – purpose, requirements, technologies – wire bonding, TAB, flip chip Wafer level packaging - technologies, reliability, wafer level burn – in and test.

Module IV **(10 hours)**

Passives – discrete, integrated, embedded – encapsulation and sealing – fundamentals, requirements, materials, processes PWB – fundamentals, standards, limitations – microvia boards – PWB assembly – SMT- Through hole assembly – design challenges Testing - Need for testing – Electrical testing – design for test

Module V **(12 Hours)**

Automatic Identification Systems: RFID tags, short range passive RFID, active and passive RFID tags, working of RFID tag, barcodes, working of a barcode scanner, parts of a barcode scanner, types of barcode readers / scanners, pen type readers, laser scanners, charge coupled devices, camera based readers, structure of a barcode, barcode printing, dot matrix printing, ink jet printing, laser printing, direct thermal printing, thermal transfer printing, factors affecting selection of the right printer, 2D barcodes, QR codes (quick response), PDF417 codes, data matrix codes, Aztec codes, maxi codes, advantages of 2D barcodes, scanning of QR-code, smart card technology and production process. Laser surface authentication biometrics for brand protection of goods and packages.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Know an idea about electronic packaging technologies.
2. Make an idea about electronic packaging materials.
3. Acquire knowledge about Thermal management, Opto electronics etc.
4. Identify RFID Tags, its reliability etc.
5. Know an idea about Single chip packaging, its functions, properties, characteristics etc.

TEXT BOOKS:

1. Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill.

REFERENCE BOOKS:

1. Blackwell (Ed), The electronic packaging handbook, CRC Press
2. Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill
3. Bosshart, Printed Circuit Boards Design and Technology, Tata McGraw Hill

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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 ***10x5 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.

PT19 803 (C)	PUBLISHING SCIENCE	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

To develop awareness about the concept of reporting& publishing in publishing industry.

SYLLABUS:

Module I **(10 Hours)**

Introduction: Publishing science, different methods of publishing, departments in a publishing house, duties and responsibilities of a publisher, job roles in publishing company, different medias of publishing, electronic media versus print media, case study.

Module II **(10 Hours)**

Publishing Organization:-

Areas of publishing – General publishing, Educational publishing, publishing, Reference publishing, Publishing text books for children, Publishing house role – Commissioning editor, Desk editor, Designer, Production manager, Sales/Marketing manager, Publishing manager.

Module III **(10 Hours)**

Editorial Process and Development: -

Copy editing, Page makeup, Proofs; Book editor – Multipurpose functions; Discussion with author; Editing educational material, Decision making role; Editorial technique – Style sheet. Reference aids; Author and his manuscript – Unsolicited manuscripts; Author – Publisher relationship, Professional guides and Societies, Literary agency.

Module IV **(10 Hours)**

News Publication: News values, writing, structure of a news report, types of news leads, writing leads, choosing news, attribution and verification, balance and fairness, news sources.

The structure of editorial department. Functions of the editor, the editorial board the news editor, sub-editor. The board meeting, crucial decisions. Letters to the editor, its importance.

Module-V **(12Hours)**

Editing: Editing its significance. Symbols of editing. Manual subbing of agency/mofussil copy. Subbing news, features, sports, political and human-interest stories and letters to the editor. Analysis of individual forms of writing selecting authors/writings. Style and techniques of language. Creative writing. Features selecting a topic.

COURSE OUTCOMES:

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

1. Identify the responsibilities and functions of publishing house.
2. Analyze the author publisher relationship and editor's functions.
3. Know about editorial process
4. Acquire knowledge about editing process
5. Steps out publishing process

TEXT BOOKS

1. D Richard Guthrie, Publishing Principle and Practice, Fifth Edition, 2011
2. ER Ram Kumar, Jaico Publishing House- Handbook of English Usage of Editors. Writers & Executives.
3. KSR Menon- Stylebook for journalists and writers
4. Doroty Bowles, Diance Bordon- Creative Editing

REFERENCE BOOKS:

1. Plotnik Arthur- The Elements of Editing
2. John, Haris.- The Complete Reporte
3. Fred Fredler- Reporting for the Media
4. Adrain Bullock, Book Production, Routledge, First Edition, 2012

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 803 (D)	PRINTING MEASUREMENTS AND CONTROL INSTRUMENTS	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- Concepts about Measurements and Control instruments that are essential for an engineer to measure and evaluate a Machine.

SYLLABUS:

Module I **(08 Hours)**

Limits, Fits and tolerances – reason for systems of limits – definitions and terminology – shaft based and hole based systems – types of fits – Tolerances – specifications – compound tolerancing – tolerance grades – Taylor's principles – limit gages. Linear and angular measurements – comparators –tool makers microscope – autocollimator – profile projector.

Module II **(08 hours)**

Geometric features – basic definition of straightness, flatness, parallelism, roundness, circularity, squareness etc. – principles and equipment's for measurement – principles of interferometry Surface roughness – Definitions – General considerations – Tally surf – Profilometer – roughness indicators – symbols in geometric features. Gears – measurements and inspections of spur gears – tooth thickness, pitch, base pitch etc. – gauging of gears. Screws – Terminology – measurement and inspection of threads – major, minor, effective diameters, pitch. – gauging of screws.

Module III **(10 hours)**

Paper tester – Introduction. **Optical Property Testers** – Brightness meters, colorimeters, glossmeters, opacimeters, Spectro colorimeters, spectrophotometers. **Printability property testers** – Absorbency testers, densitometers, Dynamic property testers, expansimeters, coefficient-of-friction testers, Hydrostatic testers, linting testers, moisture meters, picking testers, relative humidity testers. **End use property testers** – Abrasion testers, adhesion testers, adhesive testers, basic weight testers, book strength testers, bursting strengths testers, compression testers, crush resistance testers, folding endurance testers, micrometers, puncture testers, roll coating testers, stiffness testers, tearing strength testers, tensile strength testers, wet strength testers, wick resistance testers. Multiple property testers.

Module IV **(14 hours)**

Ink testers – Introduction. Working property testers – colorimeters & spectrophotometers, dispersion testers, drying time testers, drying time tester, film applicators, Ink film thickness gauges, film thickness gauge accessories, fineness-of-grind testers, Mixing scales, tack testers, tack tester accessories, viscometers, rotational viscometers, viscometer accessories, viscosity control instruments, viscosity cups, viscosity tubes, weight-per-gallon cups. End-use-property testers – Abrasion testers, exposure resistance testers, rub testers, shear/scratch testers. Process control instruments –Introduction. Photographic process control instruments – Calibration standards, Color control instruments, Densitometers. Densitometers – Densitometric terms & definitions, relationship between density & exposure, Densitometer types – visual densitometer, photoelectric densitometer, transmission, reflection & combination densitometer, practical used densitometer – calculating evenness of illumination-determining filter factor – exposure calculation.

Module V **(12 hours)**

Densitometer accessories – dot area meters, exposure control meters, film inspection system, Light integrators. Stripping process control instruments – layout gauges, screen angle gauges, screen tint specification instrument. Plate making process control instruments – Dot gain meters, light integrators, optical depth gauge. Press process control instruments – blanket gauges, durometers, fountain solution control instruments, gravure proofing instruments, ink control instruments. MICR-quality control instruments – Packing gauges, scanning densitometers, speed recording instruments, web tension control instruments. General instruments – carton crease gauge, contact coaters, hand coaters, rotary coaters, illuminators, transparency, lighting inspection, magnifiers, stereo microscopes, pH meters, pH meters, buffer sets, printability testers, printability tester accessories, sheet splitters, sound level meters, specimen cutters, surface profile measurement instruments, tack testers, pressure sensitive materials, thermometers, viewing booths, Stroboscope, Synchroscope. Robots in Testing.

COURSE OUTCOMES:

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

1. Explain different measurement system

2. Inspect different machine elements
3. 3. Acquire knowledge about different type of paper testers
4. 4. Discuss about ink properties and different type of ink testers
5. Know about different press control instruments

TEXT BOOK:

1. Gupta I.C, A Textbook of Engineering Metrology

REFERENCE BOOK:

1. R K Jain Industrial Metrology, Khanna Publishers.
2. Jennifar Hohmans- Instruments for graphic Arts.
3. Erwin Jaffe- Half tone photography.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)
20% - 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.

PT19 803 (E)	HEALTH CARE PACKAGING	L-T-P-C 3-1-0-3

PRE-REQUISITE: Packaging Technology

COURSE OBJECTIVES:

- To explain about special requirements of pharmaceutical and medical products.
- To provide knowledge about licensing and legislative requirements.

SYLLABUS:

Module I **(8 Hours)**

Introduction to Pharmaceutical Product: Types of pharmaceutical products & packages, Ethical medicines, Proprietary medicines, other classifications, Drug delivery systems, Inhalation therapies, Product spoilage mechanisms, Selection of containers, Healthcare Package requirements: Solid preparations, Powders, Semi-solid preparations, aqueous oral preparations, aqueous non-oral preparations, Non-aqueous liquid preparations, Inhalers, Medical devices.

Module II **(12 Hours)**

Package Development Requirements: Approved Materials & Its Sterilization methods, Package structure, Labeling - Text and graphics requirements, Bar codes, RFID Features, Expanded Content Labels, Package Inserts; Legislative requirements for packaging of medical preparations, Statutory requirements, General manufacturing considerations, Packaging Specification. Licensing considerations - Sources of official guidance, FDA, Influence of pharmacopoeias, License application procedure; Stability tests on finished product, Medicinal formulation/packaging compatibility, Stresses from manufacturing process, Toxicological investigations, Environmental issues, Variations, Medical devices, Case studies

Module III **(12 Hours)**

Primary Packages: Films and laminates- materials, properties, Pouches & Strip Packs, Blister Packaging - Materials, OTC Drug Packs, Ethical Drug Packs, Clinical Trial & Sample Drug Packs, Unit dose packaging, Plastic Containers – Standard containers, Dispensing Bottles, Cans, Jars; Pre-fillable Inhalers, Metered Dose, Dry Powder; Pre-fillable Syringes , Injectors, Cartridges; Tubes - Composite Tubes, Plastic Tubes, Metal Tubes; Parental Vials & Ampoules; Containers - Semi-Rigid Containers, Mini Bags; Medical Packages – Disposable gloves, Syringes, needles, catheters, dressings, sutures, surgical devices; Glass Containers; Aerosol Containers.

Module IV **(12 Hours)**

Secondary Containers and Pharmaceutical Machinery: Secondary Containers , Paperboard Containers; Prescription Dispensing Containers , Plastic Vials, Blister Packs, Glass Vials, Others; Shipping Containers , Corrugated Boxes, Folding Cartons, Trays, etc; Pharmaceutical machinery , Filling & Sealing machines for injection, infusion and screw neck bottles; ampoules; prefilled syringes and cartridges, Machinery for blister Packaging, Packaging line engineering, Line efficiency.

Module V **(8 Hours)**

Pharmaceutical Closures& Labels: Standard Pharmaceutical Closures , Plastic, Metal; Child-Resistant Dispensing Closures , Disc, Pump-Type, Turret, Plastic Dropper, Squeeze Tops; Parental Stoppers, Flip-Top Closures, Paper, Foil & Laminated Lids, Top seal, Induction seal, wads & wading systems, Other Pharmaceutical Closures; Labeling-Requirement, NDC number, label construction, Universal Product code, Global trade item number, GSI standards.

COURSE OUTCOMES:

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

1. Introduces the Quality System Regulations, offers extensive syllabus on international standards requirements on pharmaceutical and medical devices packaging and how these regulations can improve the safety and efficacy of medical products
2. Understand legislative and statutory requirements for medical package
3. Select appropriate packaging material and package design for various pharmaceutical products
4. Acquire knowledge on selecting suitable dispensing techniques for health care products
5. To understand the usage of various packaging materials in healthcare sectors

TEXT BOOKS:

1. Max Sherman, "Medical Device Packaging Handbook", 2nd edition, CRC, 1998
2. H. Lockhart, Frank Albert Paine, "Packaging of Pharmaceuticals and Healthcare Products", Springer, 1996

REFERENCE BOOKS:

1. Pharmaceutical Anti-counterfeiting by Davision Mark, copyright @ John willey son
2. Otto G. Piringer, A. L. Baner, "Plastic Packaging: Interactions with Food and Pharmaceuticals", 2nd edition, Wiley-VCH, 2008
3. William H.Erdei, "Bar Codes – Design, Printing and Quality Control", McGrawHill inc.,1998. 3.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)
20% - 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.

PT19 803 (F)	DISPLAY AND SIGNAGE	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To understand the features of sign and display industry.
- To acquire knowledge about various materials used in displays.
- To learn about the printing techniques used in display and signage industry.
- To understand the different types of converting operations.
- To study about the types of print products for display and signage industry.

SYLLABUS:

Module-I **(10Hours)**

Introduction: Sign and Display Industry Overview; Visual Branding; Marketing Campaigns; Seasonal promotions and one-off events; File formats - DWG, DXF; Plotting; Resolution, Sign Creation Software - Features.

Module-II **(12Hours)**

Materials:-Product Requirements - Durability, Light Fastness, Weather Resistance, Fire Resistance and Retardancy; Types, Properties and applications of signage and display materials - Paper, Paperboard, Corrugated boards, Sublimation transfer papers, Textile, vinyl, polyester, nylon, satin, Metallized Films, Glass, Ceramics; Inks - Aqueous, solvent, UV, Latex; Ink, Substrate – Compatibility.

Module III **(10 Hours)**

Printing Techniques :- Machine configurations, features - Wide format Inkjet Printing, Thermography, Screen Printing; Selection of printing process - Media Handling, Size, Resolution, Speed, Colours; Printing Problems - Cockling, Banding, Media Distortion.

Module-IV **(10Hours)**

Converting:- Banner - Pole Pockets, Wind Pockets, Grommets, Taping, Seaming, Welding; Coating;

Lamination - Thermal, Pressure Sensitive; Digital Finishing - Knife Cutters, Routers, Creasers, Laser engravers, Heat Sealers; Cut-to-Print Systems.

Module-V **(10Hours)**

Applications:- Outdoor Graphics - Building coverings and wraps, Flexface billboards, Backlit signage: day and night, Banners, Fleet graphics, Vehicle wraps, Transit and informational signage; Point-of Purchase (POP) Displays - Rigid POP displays, 3D POP displays, Open-box packages and displays, In-store promotions; Indoor Graphics - Branding Promotion, Popup displays, Posters, Backlit signage: day and night, Exhibition and event graphics, Floor and window graphics, Backdrops, Electro Luminance Printing.

COURSE OUTCOMES:

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

1. Identify the requirements of printed products for signage industry.
2. Select suitable material based on the requirement.
3. Comprehend the various printing technologies used in display and signage industry.
4. Appraise different types of converting operations in display and signage production.
5. Analyze the various applications of display and signage in day-to-day use.

TEXT BOOKS:

1. Elizabeth Allen, Sophie Trianta phillidou Dara, The Manual of Photography and Digital Imaging, Tenth edition, Focal Press, 2009
2. Helmut Kipphan, Handbook of Print Media, GATF, 2001

REFERENCE BOOKS:

1. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.
2. Vincent Blyden, Graphic Communication Materials and Processes, BookSurge Publishing, 2008

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 804 (A)	NEWSPAPER AND PERIODICAL PUBLISHING	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To discuss about the complex process of newspaper & periodical publishing industry.
- To discuss about the concepts on news and editing.
- Describes about the production and workflow of newspaper and magazine organizations.

SYLLABUS:

Module-I **(10 Hours)**

Newspaper Organization & Management: -Organizational structure & functions, Determinants to work, organization; Owner, editorial organization, management; Flow charts of staff in newspaper organization; management, Incoming materials, financial aspects, Production, advertising, distribution and promotion. The role of copy editors, city editors, news editors, editorial cartoonist, artists, Sunday editor, sports editor, business editor, journalists & reporters; editorial responsibilities.

Module -II **(12 hours)**

News And Editing:-Basic determinants of News; impact, unusual and prominent: Additional determinants of news; conflict, proximity, timeliness, currency. Gathering the news, source of news; Beat system, interviewing, wire services, syndicate, news writing, copy preparation, features &reviews, Editorial and opinion columns, sports and photo production; editing Manuscript editing, creative and substantive editing, technical editing, editing conference proceeding, editing a successful journal; copy desk, proof reading, photo editing.

Module-III **(12 Hours)**

Production & Workflow: Manuscripts from editorial organization: layout &design; Parts of a newspaper, The importance of visual appeal in page-making. Playing up/ down a story. Colour, boxing, Verbal and non- verbal languages in design. Graphics/ diagrams and illustrations and importance. Art work; colour, first proof; Lab work to be given to prepare a Newspaper and a periodical for a given manuscript.

Module-IV **(10 Hours)**

Periodical Publishing; The Campus magazine, the professional magazine, writer-editor relationships, magazine copy editing, writing headlines and titles, picture editing and using colours, layout and design, printing, financial aspects of a new journal, completing journal issues. The press and the law libel, defense against libel, mitigation & damages.

Module-V **(8 Hours)**

Legal Aspects:- The press and the law liabilities, defense against libel, mitigation & damages, Digital Rights Management, Watermarking, Readership strategies & trends, Distribution model for newspapers & magazines, Future developments.

COURSE OUTCOMES:

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

1. Comprehend the operations of newspaper and magazine companies and their organizational structure.
2. Analyze the concepts on news and editing.
3. Assess the production and workflow of newspaper and magazine organizations.
4. Identify the different periodical publishing.
5. Recognize legal aspects in publishing.

TEXT BOOKS:

1. Carter Nancy M, The Computerization of Newspaper Organizations, University Press of America, 2002
2. Daryl R. Moen, Newspaper Layout & Design: A Team Approach, Iowa State Press, 2000

REFERENCE BOOKS:

1. Helmut Kiphhan, Handbook of Print Media, Springer Verlag, 2001
2. James E. Pollard, Principles Of Newspaper Management, Mcgraw-Hill Book Company, Inc, 1937
3. Melvin Mencher, Basic News Writing, Wm.C.Brown Company Publishers, Dubuque, Iowa, 1983.
4. Robert H.Bohle, From News to Newsprint, Prentice Hall Inc., 1992

5. William L.Rivers, Magazine Editing in the 80's, Wadsworth Publishing Company,Belmont, California, 1983.
6. William L.Rivers, News Editing in the 80's, Wadsworth Publishing Company, Belmont, California, 1983.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)
20% - 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.

PT19 804 (B)	PACKAGING MANAGEMENT	L-T-P-C 3-1-0-3

PRE-REQUISITE: Packaging Technology

COURSE OBJECTIVES:

- To introduce the fundamental knowledge in the packaging management.
- To provide an overall knowledge about the packaging production planning and control.
- To provide a basic knowledge about the packaging quality management.
- To provide a basic knowledge about the packaging waste management.

SYLLABUS:

Module I **(10 hours)**

Packaging-Prepress Management: Introduction, prepress designing software - Artios CAD, Art Pro, Automation Engine, CAPE Pack, Cape Truck Fill, color management tools - Color Engine, Digital Flexo Suite, Dot spy, Dynamic Content, I-Cut Suit, RIP solutions and imaging engines – FlexiRip, Preflight and pre-flighting software - Neo & Pantone line, layout software – Plato

Module II **(11 hours)**

Packaging-Production Planning and Control: Multifaceted online packaging management solution- web centre, digital flexo solution - CDI, Full HD flexo, labels and designing, workflow - JDF, PDF and CIP3/CIP4, equipment planning, change over point analysis, financial aspects of equipment investing. production planning, scheduling and control, material purchasing and inventory control, quality control, work allocation, single product line scheduling using SPT, EDD and network analysis, multiproduct scheduling using Gantt Chart, scheduling dynamics. production control systems, inventory optimization.

Module III **(10 hours)**

Packaging-Quality Management: Introduction to quality and quality control, control charts - X bar and R charts, charts for attributes, pareto analysis & fish bone charts, scientific quality management tools - 5S, Kaizen, six sigma, lean manufacturing, balance score card, value stream mapping, business process re-engineering, scheduling techniques - PERT and CPM.

Module IV **(10 hours)**

Packaging-Costing and Work Measurement: Quality and cost, costs associated with packaging design, production and transportation, wages and incentives - factors affecting wage system, types, schemes, incentive plans, work measurement and method study, value analysis, work scheduling - strategies, forward and backward scheduling, finite loading, critical ratio scheduling, index method, CPM and Gantt chart techniques

Module V **(11 hours)**

Packaging-Waste Management: Techniques - Recycling, composting, landfills, burning the waste material, waste management for food, plastic, corrugated boards, methods of waste disposal - reuse, recover, recycle, packaging materials, packaging wastage & treatment, effect of waste producer's behaviour on volume of waste generated, solid waste infrastructure in packaging, waste treatment, life cycle assessment in packaging - life cycle assessment, data collection procedure for ICA, life cycle assessment for container glass - life cycle assessment of north American container glass, making of glass, CO2 savings from glass recycling, key environmental impact and indicator results, key environmental concerns about glass, light weighting, life cycle assessment in corrugated packaging - life cycle inventory and environmental impact, influence of EOL situation on life-cycle performance, biogenic carbon handling.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Get a thorough knowledge about the Packaging Pre press Management.
2. Understand about Packaging Production Planning and Control.
3. Know an overall knowledge about Packaging Quality Management.
4. Summarize the concept of Packaging Costing & Work Measurement.
5. Comprehend the overall knowledge about Packaging Waste Management.

TEXT BOOKS:

1. Martand T Telsang, Production Management, S Chand & Co. Ltd, 2007.
2. Gary G Field, Printing Production Management, Graphics Arts publishing Inc.,1996.

3. Porter, Dereck, Print Management, Pira International, leatherhead survey, 1993

REFERENCE BOOKS:

1. Geis, A John, Printing Plant layout and Facility Design Hand book, GATF, 1991.
2. Salvendy, Gavriel, Hand book of Industrial Engineering, John Wiley & Sons, Inc., 2nd Edition, 1991.
3. Merit, Don, Excellence in Scheduling Print Production, 1992.

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 804 (C)	ON DEMAND PRINTING	L-T-P-C 3-1-0-3

***PRE-REQUISITE*:** Nil

COURSE OBJECTIVES:

- It is a digital concept and this paper gives details about customized printing methods.
- To understand scope of commercial online services in printing.
- To understand different types of networks used in printing firm.

SYLLABUS:

Module I **(14 Hours)**

Introduction. Defining "On Demand". Defining Digital Printing. Defining variable printing. Typical lengths. Short-run process colour printing. On demand printing & Publishing concepts. Future on demand. Market research-Market subset, where are pages created. Number of originals and run length. New technologies shift existing methods. Economics of on demand printing- Economic of long run. Advantage for the buyer. Efficiencies of Digital on demand work flow. Short-run pricing paradox.

Module II **(10 Hours)**

Customizing traditional print. Customized on-demand print. The future. Other forces of change-Interactivity advantage. Online interactivity advantage. Interactive TV. Demographics. Advantages of search & Retrival. Alternative media CD-ROM's. Manufacturing costs-Paper mailing. Alternative media-online. Commercial online services. Commercial applications-Just in time. Appropriate applications for on demand & DP. Advertising. Author reprints. On demand products.

Module III **(08 Hours)**

Marketing and selling on-demand services- TV programming and ATM cards. Value added. Advantages of On demand. Selling factors. Accepting digital files-File transfer for on-demand.

Module IV **(10 Hours)**

Networks for printing. Networks for publishing. Networks for in house. Ideal Network. WAN (Wide Area Networks). Flexibility. Changing Markets for Print. Market projections, projections of changes in the number of colors. Moving towards shorter runs.

Module V **(10 Hours)**

Overview. Print engines. Press director. Multiple runs. Open pre press interface. Colour consistency. User experience, Service. Cost of consumables. Rip station, Satellite press, Web press software suit.

COURSE OUTCOMES:

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

1. Explain scope of on demand printing
2. Discuss about customized on demand printing features
3. Acquire knowledge about roll of on demand printing in marketing
4. Explain different types of networks used in printing firms
5. Know basics about processing of different type of digital files in prepress

TEXT BOOKS:

1. Howard M Fenten. Frank. J. Romano.- On Demand Printing

REFERENCE BOOK:

1. Martin Graham,Non impact printing, pira internatinl ,UK,1992
2. Phil Green, understanding digital color, GATF and PIRA,USA

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 804 (D)	FUNDAMENTALS OF ELECTRONIC MEDIA	L-T-P-C 3-1-0-3

***PRE-REQUISITE*:** Nil

***COURSE OBJECTIVES*:**

- To learn the basics of digital media production
- To understand digital transmission systems
- To learn the technologies used in digital transmission
- To obtain knowledge about different devices used in digital transmission

SYLLABUS:

Module 1 **(10 Hours)**

Broadcasting Basics: Analog radio, digital radio, satellite radio, audio blogging, RSS, pod safe music, analog television, digital television, cable television, video hosting, download services, internet radio and television, digital media production, sound and vision, image capture techniques, web-based social interaction.

Module II **(10 Hours)**

Transmission Standards and Systems: Transmission, reception lines and other equipment, various modes of receiving systems, FM and TV antenna towers, translators and repeaters, transmitter remote controls, mobile phone media production - SMS, MMS, mobile phone media delivery, streaming and video on demand.

Module III **(12 Hours)**

Transmitter Systems: Satellite distribution, uplink terminals, transmitter power system equipment, masts, towers and antennas, earth station types - uplink earth stations, downlink earth stations, outside broadcasting vehicles and mobile control room, microwave links - OB and ENG, power generators and electrical system - OB, battery systems.

Module IV **(12 Hours)**

Mobile and Emerging Technologies**:** Information technology, computer storage, computer networks, internet streaming, web streaming, audio and video streaming, flash streaming, MP3 streaming (radio), peer to peer distribution, digital video broadcasting via satellite services to handhelds (DVB-SH) technology, Wi-fi and Wi-Max, Li-Fi, podcasting, I-Pod, interactive portals.

Module V **(8 Hours)**

Virtual and Augmented Reality: Definition, applications, real-time computer graphics, augmented and virtual reality, input devices, output devices.

COURSE OUTCOMES:

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

1. Explain about different digital services
2. Acquire knowledge about standards used in transmission
3. Discuss about how information processing in digital transmission
4. Know about emerging technologies used in digital transmission
5. Identify virtual reality systems and its applications

TEXT BOOKS:

1. Brian Winston, Media Technology and Society: A History from the Telegraph to the Internet, Rutledge, 2000.
2. Graham Jones, A Broadcast Engineering Tutorial for Non-Engineers, Focal Press, 2005.
3. E.P.J. Tozer, Broadcasting Engineering Reference Book, Focal Press, 2004.

REFERENCE BOOKS:

1. Borko Furht and Syed A. Ahson, Handbook of Mobile Broadcasting, Taylor & Francis, 2008.
2. Wes Simpson, Video over IP: IPTV, Internet Video, H.264, P2P, Web TV, and Streaming: A Complete

EVALUATION SCHEME:

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 804 (E)	VISUAL AND MASS COMMUNICATION	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To understand the Importance of Visual Communication.
- To infer the basic concepts in creating visual images.
- To be aware of fundamentals in film making process.
- To learn about various applications in different media.
- Apply the principles of visual communication to various media.
- Design using the various visual communication theories.

SYLLABUS:

Module I **(12 Hours)**

Introduction: Visual arts history from cave drawings to video painting, identifying and analysing hidden languages in various media and cultures, Need and importance of Communication, Communication theories and models, Principles of visual communication, Psychology of human vision, How the eye and brain process image, Visual grammar, Colour form, Depth and movement, Visual theories, Perception, Semiotics, Visual story creation; Principles of Design – The applications of design principles in creating visual images.

Module II **(12 Hours)**

Visual Analysis: Visual persuasion and propaganda, understanding an image, Analysis Models, Visual image analysis – Perspectives, stereotypes and the media, Ethics of visual story telling; Standard Observer, Basics of film making, Planning, pre-production- Concept / Story development, Scripting / Screen play writing, Budgeting, Casting, Locations, Financing. Production-Shooting, Direction & Cinematography. Post production- Editing, Sound recording, Dubbing, Special effects, Graphics & Final mixing. Distribution & Exhibition.

Module III **(8 Hours)**

Application of Visual Communication: Overview of print, Photography, Video and audio media, Study of techniques and methods of applying visual communication in newspapers, magazines, video, internet, advertising and public relations. Analysis of a visual event–film, TV, photo exhibit, advertisements, Case studies, Standard observer.

Module IV **(12 Hours)**

MC Introduction: Communication and its types, History and evolution of communication, Communication theories, Verbal and non-verbal communication, formal and informal communication, Role of mass media in society. Current trends in communication

News reporting and editing, Fundamentals of reporting, news gathering, evaluation, news writing & newsroom procedures, Depth reporting, Trend reporting, Investigative reporting, Economic and Science reporting, Preparation of news copy for publication, Copy reading, Rewriting, Proof reading, Page making, Typography, Picture editing.

Module V **(8 Hours)**

Newspaper feature and magazine, non-fiction writing, writing editorials, analytical articles, reviews, columns, commentaries & analysis broadcast journalism Gathering & reporting news for radio & television, The structure, functions and administration of a news and public affairs department in a broadcast station. Radio/TV station management, Audio-Visual communication, Audio-visual aids & techniques, use of non-projected and projected aids as black boards, Charts, Graphs, Film appreciation, principles and techniques of various types of communication research.

COURSE OUTCOMES:

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

1. Understand and Apply communication theories in Mass Media.
2. Gather news and convert it into a news report for publishing.
3. Develop content for different media.
4. Analyse the functionary of Radio and Television Media.
5. Use the various tools and techniques for audio visual communication.

TEXT BOOKS:

1. Arthur Asa Berger, Essentials of Mass Communications Theory, SAGE Publications, 1995.

2. Denis McQualil, Mass Communication Theory; An Introduction to Theories of Mass Communication, 5th Edition, Melvin L.DeFluer, Sandra Bale-Rokeach, Sage Publications, 1999.
3. Gregg Beryman, Notes on Graphic Design & Visual Communication, Crisp Publications, 1990.
4. Gunther R.Krers, Theo Van Ceeuwen, Routledge, Gunther R.Grers, Reading Images – The Grammar of Visual Design, Routledge Publishers, 1995

REFERENCE BOOKS:

1. Jennings Bryant, Dolfzillmann, Media Effects; Advances in Theory and search, 2nd Edition, Lea Publishers, 2002.
2. Melvin L. Deflear, Sandra Bale-Rokeach, Theories of Mass Communication, 5th Edition, Allyn and Bacon Publishers, 1999.
3. Horn, Robert, Visual Language, Macro UV Publishers, 1999.
4. Kosternics, Charles and David Roberts, Designing Visual Language,2ndEdition, Allyn & Bacon, 1999

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)
20% - 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.

PT19 804 (F)	INDUSTRIAL SAFETY ENGINEERING	L-T-P-C 3-1-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- Identify unsafe conditions and recognize unsafe alerts.
- Interpret the rules and regulations for safety operations.
- Capable of solving problem of accidents.
- Capable of solving the present for criticizing the present for improved safety.
- Collaborate and modify processes / procedures for safety.

SYLLABUS:

Module-I **(10Hours)**

Evolution of modern safety concepts in Printing Industry – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

Module-II **(10Hours)**

Chemical exposure during Press Operations – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

Module-III **(10Hours)**

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

Module-IV **(10Hours)**

System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.

Module-V **(10Hours)**

Explosions – Disaster management – catastrophe control, hazard control, Factories Act. Recommendations of OSHA in Printing Industry.

COURSE OUTCOMES:

Upon the completion of this course, Students will be able to: -

1. Identify and prevent chemical, environmental mechanical, fire hazard.
2. Collect, analyze and interpret the accidents data based on various safety techniques.
3. Apply proper safety techniques on safety engineering and management.
4. Able to perform hazard analysis.
5. Aid to design the system with environmental consciousness by implementing safety regulation.

TEXT BOOK:

1. John V.Grimaldi, "Safety Management", AITB S Publishers, 2003.

REFERENCES:

1. David L.Goetsch, "Occupational Safety and Health for Technologists", Engineers and
2. Managers, Pearson Education Ltd. 5th Edition, 2005.
3. Deshmukh L M, "Industrial Safety Management", Tata McGraw-Hill Publishing Company Ltd.,2005
4. Safety Manual, "EDEL Engineering Consultancy", 2000.

EVALUATION SCHEME:

Internal Continuous Assessment (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - 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.

PT19 805 (P)	SEMINAR	L-T-P-C 0-0-6-2

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To assess the ability of the student to study and present a seminar on a topic of current relevance in the field of Printing Technology or allied areas.
- To develop skills in doing literature survey, technical presentation and report preparation.

SYLLABUS:

Seminar is intended to encourage and motivate the students to explore the latest trends in technology related to their area of interest confined to the relevant discipline. They need to identify a topic from latest technical publications including peer reviewed journals, conference proceedings, technical reports, books etc. The student need to prepare a report based on a topic and present it before a team of faculty and students. A faculty member can guide maximum of five students of his 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. A committee consisting of three faculty members can evaluate the seminar presentation and report. The evaluation can be based on various factors like, depth of knowledge in the topic, presentation skills, confidence level of the candidate, ability in answering questions etc. Due consideration will be given to the technical content, adequacy of references, and overall presentation and quality of the candidate's seminar report during the evaluation process.

COURSE OUTCOMES:

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

- Analyze a current topic of professional interest and present it before an audience.
- Review literature on a given advance topic related to the specific stream.
- Prepare a summary of various concepts systematically after considerable study of the content from primary as well as secondary sources.
- Present and discuss the concept & conclusion in an open seminar.
- Present technical report as per specified norms.

Internal Continuous Assessment (Maximum Marks-100, Minimum required to pass-50)

10% - Attendance

20% - Seminar Guide

30% - Technical content of the report

40% - Presentation

PT19 806 (P)	PROJECT PHASE-II	L-T-P-C 0-0-8-6

PRE-REQUISITE: Project Phase I

COURSE OBJECTIVES:

- To enable the students to apply the engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.
- To design and develop a software/hardware project to innovatively solve a real-world problem.

SYLLABUS:

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least two Interim Evaluation and a final evaluation of the project in the 8^{th} semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation.

Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the HOD or a senior faculty member, guide and three/four faculty members specialized in different streams in Printing Technology.

COURSE OUTCOMES:

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

- Apply engineering knowledge in practical problem solving.

- Develop creative thinking in finding viable solutions to engineering problems.
- Design innovative products, processes or systems.
- Practice team dynamics to work effectively in a team for the development of technical projects.
- Develop skills in technical presentation and report preparation.

Assessment Pattern

The Continuous Internal Evaluation (CIE) will be conducted as 2 Interim evaluations and a final evaluation.

The Interim evaluation, 2 times in the semester will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a project evaluation committee appointed by Head of the Department. First evaluation is to assess the progress of the work, presentation and discussion. Second Evaluation would be a pre-submission presentation before the evaluation committee to assess the quality and quantum of the work done. It is advised to invite the project guide of the concerned batch for the final evaluation.

The final evaluation committee comprises Project coordinator, two faculty members/ expert from Industry/research Institute/ senior faculty from another department (for interdisciplinary projects-(if any)).

Internal Continuous Assessment **(Maximum Marks-100, Minimum required to pass-50)**

30% - Project Guide

20% - Interim evaluation by the evaluation committee

20% - Quality of the report evaluated by the above committee

30% - Final evaluation by a three- member faculty committee

PT19 807 (P)	VIVA-VOCE	L-T-P-C 0-0-0-3

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

- To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination

SYLLABUS:

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. course, seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level.

For final viva-voce, candidates should produce certified reports of Internship, Seminar and Project. If he/she has undergone industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce.

COURSE OUTCOMES:

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

- Demonstrate knowledge in the program domain.
- Present his views cogently and precisely
- Exhibit professional etiquette suitable for career progression

Assessment in Viva Voce **(Maximum Marks-100, Minimum required to pass-50)**

10% - Industrial training/industrial visit/educational tour or Paper presented at National-level

20% - Seminar

30% - Project

40% - Subjects