Faculty of Engineering & Technology

Syllabus

For

Bachelor of Technology (B. Tech.)

In

Mechanical Engineering (ME)

(Program Code: ET0141ME)

(2023-24)

****Approved by the Academic Council vide resolution no ……***

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1. INTRODUCTION

The quality of technical education should be improved in such a manner that engineering graduates are able to compete globally in terms of their knowledge and skills and serve for the society and nation. And for this purpose Learning Outcome-based Curriculum Framework (LOCF) is developed.

Incorporation of Learning Outcome-based Curriculum Framework (LOCF) in the Graduate program like B. Tech. makes it student-centric, interactive and outcome-oriented to achieve well-defined aims, objectives and goals. The learning outcomes are attained by students through development of skills acquired during the program of study by providing them practical exposure. Program learning outcomes will include subject-specific skills and generic skills, including transferable global skills and competencies. It would also focus on knowledge and skills that prepare students for further study, employment and society development. LOCF help ensure comparability of learning levels and academic standards across colleges/universities.

At present, the goal of technical education may be achieved using the following measures:

i. Curriculum reform based on learning outcome-based curriculum framework (LOCF).
ii. Improving learning environment and academic resources.
iii. Elevating the quality of teaching and research.
iv. Involving students in discussions, problem-solving and out of box thinking about various ideas and their applicability, which may lead to empowerment and enhancement of the social welfare.
v. Motivating the learners to understand various concepts of their educational program keeping in view the regional context.
vi. Enabling learners to create research atmosphere in their colleges/ institutes/ universities.
vii. Teach courses based on Choice Based Credit System (CBCS).

2. LEARNING OUTCOME-BASED APPROACH TO CURRICULUM PLANNING

The Bachelor of Technology (B. Tech.) degree is awarded to the students on the basis of knowledge, understanding, skills, values and academic achievements. Hence, the learning outcomes of this program are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for knowledge.

The course for B. Tech. is designed according to outcome based approach in the light of graduate attributes, description of qualifications, courses and program learning outcomes. It may lead to all round development and delivery of complete curriculum planning. Hence, it provides specific guidelines to the learners to acquire sufficient knowledge during this program.

The program has been planned in such manner that there is scope of flexibility and innovation in

i. Modifications of prescribed syllabi.

ii. Teaching-learning methodology.

iii. Assessment technique of students and knowledge levels.

iv. Learning outcomes of courses.

v. Addition of new elective courses subject to availability of experts in colleges/institutes/universities across the country.

2.1. Nature and Extent of Undergraduate Program

As a part of effort to enhance employability of engineering graduates the outcomes based curriculum are very essential in present day perspective. Therefore, higher education degrees must formulate Graduate Attributes (GAs), qualification descriptors, learning outcomes and course learning outcomes which will help in curriculum planning and development in the form of design and delivery of courses. The overall formulation of the degree program must equip learner to have competencies to provide deliverables to the industry.

2.2. Aims of undergraduate program (B. Tech.)

The overall aims of B. Tech. program are to:

ii. Create deep interest in Practical learning.

iii. Develop broad and balanced knowledge and understanding of definitions, concepts and principles.

iv. Familiarize the students with suitable tools related to designing, modeling etc.

v. Enhance the ability of learners to apply the knowledge and skills acquired by them during the program to solve specific problems of their courses.

vi. Provide learners sufficient knowledge and skills enabling them to undertake higher studies in technical field.

vii. Encourage the students to develop a range of generic skills helpful in employment, internships and social activities.

2.3. Motive behind curriculum planning and development

The committee considered and discussed the following factors for LOCF for the graduates:

1) Framing of syllabi
2) Learners attributes
3) Qualification descriptors
4) Program learning outcomes
5) Course learning outcomes
6) Necessity of having elective courses
7) Academic standards

3. PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

The program educational objectives are set in line with Institutional and Departmental mission statements. The program educational objectives of Bachelor of Technology is to produce engineers who later take the responsibility of engineering professionals and researchers with following qualities:

- **PEO1.** Apply basic knowledge of mathematics, principles of physics and chemistry, and interdisciplinary engineering for the design and development.
- **PEO2.** Demonstrate the application of exploration practices and engineering principles through development of innovative tools that are beneficial in production.
- **PEO3.** Exhibit skills of design and construct machineries based on requirement and need of Technology operations.
- **PEO4.** Exhibit strong, independent learning, analytical and problem solving skills with special emphasis on design, communication, and ability to work in teams.
- **PEO5.** To have successful career as engineering professional or a researcher through lifelong learning in the field of Bachelor of Technology.

4. GRADUATION ATTRIBUTES (GAs)

The graduate attributes in B. Tech. are the summation of the expected course learning outcomes mentioned in the end of each course. Some of them are stated below.

GA1: Discipline-specific Knowledge: Capability of demonstrating comprehensive knowledge of B. Tech. program and understanding of core branch so that it forms a foundation for a graduate program of study.

GA2: Critical Thinking & Analytical Reasoning: Ability to employ critical thinking in understanding the concepts relevant to the various branches of engineering. Ability to analyze the results and apply them in various problems appearing in different streams.

GA3: Problem Solving: Capability to solve problems by using research-based knowledge and research methods including innovative thinking, design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

GA4: Research-related skills: To develop a sense of inquiry and capability for asking relevant and intelligent questions, problem identification, synthesizing and articulating; ability to recognize and establish cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

GA5: Usage of Modern Tools (Information/digital literacy): To create, select, and apply appropriate techniques, resources, and modern science and IT tools including prediction and modeling to complex science activities with an understanding of the limitations.

GA6: Social Responsibilities: Ability to work with contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

GA7: Self-directed learning with environment: Ability to work independently and do in-depth study of various problems and requirements of society with natural available resources which leads to sustainable development.

GA8. Moral and ethical awareness/reasoning: Ability to identify unethical behavior such as falsification or misrepresentation of data and adopting objective, unbiased and truthful actions in all aspects of their program.

GA9. Leadership Readiness/Qualities: Capability for mapping out the tasks in a team or an organization, self-motivating and inspiring team members to engage with the team objectives/vision; and using management skills to follow the mapped path to the destination in a smooth and efficient way.

GA10: Communication skills:

a. Ability to communicate various concepts of technical education effectively using practical approach and their geometrical visualizations.

b. Ability to use courses as a precise language of communication in other branches of human knowledge.

c. Ability to resolve unsolved problems and requirements of industries and societies.

d. Ability to show the importance of their technical knowledge as precursor to various scientific developments since the beginning of the civilization.

GA11: Project Management and Finance: Ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

GA12: Lifelong learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

5. QUALIFICATION DESCRIPTORS (QDs)

The qualification descriptor suggests the generic outcomes and attributes to be obtained while obtaining the degree of B. Tech. The qualification descriptors indicate the academic standards on the basis of following factors:

1. Level of knowledge
2. Understanding
3. Skills
4. Competencies and attitudes
5. Values.

These parameters are expected to be attained and demonstrated by the learners after becoming graduates in this program. The learning experiences and assessment procedures should be so designed that every graduate may achieve the program learning outcomes with equal opportunity irrespective of the class, gender, community and regions. Each graduate in engineering should be able to:

I. Demonstrate fundamental systematic knowledge and its applications. It should also enhance the subject specific knowledge and help in creating jobs in various sectors.

II. Demonstrate educational skills in areas of their program.

III. Apply knowledge, understanding and skills to identify the difficult/unsolved problems in courses of their program and to collect the required information in possible range of sources and try to analyze and evaluate these problems using appropriate methodologies.

IV. Apply one's disciplinary knowledge and skills in newer domains and uncharted areas.

V. Identify challenging problems and obtain well-defined solutions.

VI. Exhibit subject-specific transferable knowledge relevant to job trends and employment opportunities.

6. PROGRAM LEARNING OUTCOMES (POs)

Students graduating with the B. Tech. degree should be able to acquire with following PLOs

PLO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PLO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PLO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PLO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PLO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PLO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PLO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PLO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PLO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PLO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply

these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PLO12. Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Mapping of Graduate Attributes (GAs) and Program Learning Outcomes (PLOs):

PLO/GA	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PLO1	■											
PLO2		■										
PLO3			■									
PLO4				■								
PLO5					■							
PLO6						■						
PLO7							■					
PLO8								■				
PLO9									■			
PLO10										■		
PLO11											■	
PLO12												■

7. PROGRAM SPECIFIC OUTCOMES (PSO's) :

PSO1: Professionally empowering the student as technical manpower in industry or an entrepreneur for production analytics and innovation.

PSO2: Able to excel in various technological challenges and contribute for self-reliant society.

8. TYPES OF COURSES

1. Courses in a program may be of four kinds: Core, Elective, Ability Enhancement and Skill Enhancement.

a) Core Course:-

There may be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a requirement to complete the program in a said discipline of study.

b) Elective Course:-

Elective course is a course which can be chosen from a pool of papers. It may be

1) Supportive to the discipline of study
2) Providing an expanded scope

3) Enabling an exposure to some other discipline/domain

4) Nurturing student's proficiency/skill.

An Elective Course may be 'Discipline Centric/Specific' & Generic Elective

Discipline Centric/Specific Elective (DSE): Elective courses offered under the main discipline/subject of study are referred to as Discipline Centric/Specific.

Generic/Open Elective (GE): An elective course chosen from an unrelated discipline/subject is called Generic/Open Elective. These electives will be focusing on those courses which add generic proficiency of students.

c) Ability Enhancement Compulsory Courses (AECC):-

AECC courses are based upon the content that leads to knowledge enhancement, for example: English Communication, Environment Science/ Studies, etc.

d) Skill Enhancement Courses (SEC):-

SEC Courses provide value based and/or skill based knowledge and may content both Theory and Lab/Training/Field Work. The main purpose of these courses is to provide students life- skills in hands- on mode so as to increase their employability.

2. List of Course

a) Core Course:-

- Engineering Mathematics-I
- Engineering Physics
- Engineering Physics Lab
- Engineering Mathematics-II
- Engineering Chemistry
- Engineering Chemistry Lab
- Engineering Mathematics-III
- Engineering Mechanics
- Basic Civil Engineering
- Basic Civil Engineering Lab
- Basic Electrical Engineering
- Basic Electrical Engineering Lab
- Engineering Thermodynamics
- Materials Science and Engineering
- Mechanics of Solids
- Machine drawing practice
- Materials Testing Lab
- Basic Mechanical Engineering Lab
- Probability and Sampling Theory
- Fluid Mechanics & Fluid Machines
- Manufacturing Processes

- Theory of Machines
- Digital Electronics Lab
- Fluid Mechanics Lab
- Production Practice Lab
- Theory Of Machine Lab
- Mechatronics Systems
- Heat Transfer
- Manufacturing Technology
- Design Of Machine Elements I
- Principles Of Management
- Mechatronics Lab
- Heat Transfer Lab
- Production Engineering Lab
- Machine Design Practice Lab
- Industrial Training/ Seminar
- Measurement & Metrology
- Mechanical Vibrations
- Design of Machine Elements II
- Non Conventional Machining Methods
- CIMS Lab
- Vibration Lab
- Machine Design Practice II Lab
- Thermal Engineering Lab
- Industrial Training/ Seminar
- Machine Learning Lab
- FEA Lab
- Thermal Engineering Lab-II
- Quality Control Lab
- Industrial Training
- Seminar
- Industrial Engineering Lab
- Metrology Lab
- Project

Elective Course:-

- Steam Engineering
- Automobile Engineering
- Robotics
- Refrigeration & Air Conditioning
- Machine Learning
- Micro electro and mechanical systems (MEMS) and Microsystems
- I.C. Engines
- Operation Research

- Turbo machines
- Non Destructive System
- Environmental Engineering and Disaster Management
- Power Generation Sources
- Hybrid and Electric Vehicles
- Supply and Operations Management
- Additive Manufacturing
- Finite Elements Methods
- Energy Management
- Waste and By-product Utilization
- Medium And Small Enterprises Management
- Industrial Psychology
- Project Management
- Finance & Accounting
- Power Plant Engineering
- Industrial Engineering
- Non Destructive Systems
- Power Generation
- CIMS
- Renewable Energy Engineering
- Product Innovation & Entrepreneurship
- Waste & By product utilization
- Medium and Small Enterprises management

c) Humanities, Social Science And Management Course (HSMC):-

- Communication Skills
- Universal Human Values
- Environment Studies
- Human Values Activities
- Fundamentals of Indian Knowledge Systems
- Leadership & Management Skills
- Professional Skills
- Critical Thinking

Computation of Workload:

Lecture (L) : 1 Credit = 1 Theory period of one hour duration

Tutorial (T) : 1 Credit = 1 Tutorial period of one hour duration

Practical (P) : 1 Credit = 1 Practical period of two hour duration

d) Course code and definition

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses

9. PROGRAM STRUCTURE B. Tech. (ME) 2023-27 AICTE Model

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	BSC	30	70	100	3	1	-	4
BTBSC102A/ BTBSC102B	Engineering Physics/ Engineering Chemistry	BSC	30	70	100	3	1	-	4
BTHSMC103	Communication Skills	HSMC	30	70	100	2	-	-	2
BTESC104	Programming for Problem Solving	ESC	30	70	100	3	-	-	3
BTESC 105A/ BTESC 105B	Basic Civil Engineering/ Basic Electrical Engineering	ESC	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC106A/ BTBSC106B	Engineering Physics Lab/ Engineering Chemistry Lab	LC	60	40	100	-	-	1	1
BTHSMC107	Language Lab	LC	60	40	100	-	-	1	1
BTESC108	Computer Programming Lab	LC	60	40	100	-	-	1	1
BTESC 109A / BTESC 109B	Basic Civil Engineering Lab/ Basic Electrical Engineering Lab	LC	60	40	100	-	-	1	1
BTESC110	Computer Aided Engineering Graphics	LC	60	40	100	-	-	1	1
BTHSMC111	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	Total		**550**	**550**	**1100**	**14**	**2**	**5**	**22**

Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	Engineering Mathematics-II	BSC	30	70	100	3	1	-	4
BTBSC202A/ BTBSC202B	Engineering Chemistry / Engineering Physics	BSC	30	70	100	3	1	-	4
BTHSMC203	Universal Human Values	HSMC	30	70	100	2	-	-	2
BTESC204	Basic Mechanical Engineering	ESC	30	70	100	2	-	-	2
BTESC205A/ BTESC205B	Basic Electrical Engineering/ Basic Civil Engineering	ESC	30	70	100	3	-	-	3
BTVAC206	Environment Studies	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC 207A/ BTBSC 207B	Engineering Chemistry Lab/ Engineering Physics Lab	LC	60	40	100	-	-	1	1
BTESC208	Manufacturing Practices Workshop	LC	60	40	100	-	-	1	1
BTESC209A/ BTESC209B	Basic Electrical Engineering Lab/ Basic Civil Engineering	LC	60	40	100	-	-	1	1
BTESC210	Computer Aided Machine Drawing	LC	60	40	100	-	-	1	1
BTHSMC 211	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	Total		**520**	**580**	**1100**	**16**	**2**	**4**	**22**

SEMESTER: III

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEBSC301	Engineering Mathematics-III	BSC	30	70	100	3	-	-	3
BTMEESC302	Basic Electronics Engineering	ESC	30	70	100	3	-	-	3
BTMEESC303	Engineering Mechanics	ESC	30	70	100	3	1	-	4
BTMEPCC304	Engineering Thermodynamics	PCC	30	70	100	3	-	-	3
BTMEPCC305	Materials Science and Engineering	PCC	30	70	100	3	-	-	3
BTMEPCC306	Mechanics of Solids	PCC	30	70	100	3	1	-	4
BTMEHSMC307	Fundamentals of Indian Knowledge System	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC308	Machine drawing practice	LC	60	40	100	-	-	1	1
BTMEPCC309	Materials Testing Lab	LC	60	40	100	-	-	1	1
BTMEPCC310	Basic Mechanical Engineering Lab	LC	60	40	100	-	-	1	1
BTMEESC311	Basic Electronics Engineering Lab	LC	60	40	100	-	-	1	1
BTMEPROJ312	Industrial Training/Seminar	PROJ	60	40	100	-	-	-	1
BTMEHSMC 313	Social Outreach, Discipline & Extra Curricular Activates	HSMC	100	-	100			-	1
TOTAL			**610**	**690**	**1300**	**20**	**2**	**4**	**28**

Semester-IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEBSC401	Probability and Sampling Theory	BSC	30	70	100	3	-	-	3
BTMEHSMC402	Critical Thinking	HSMC	30	70	100	2	-	-	2
BTMEPCC403	I C Engine	PCC	30	70	100	3	-	-	3
BTMEPCC404	Fluid Mechanics & Fluid Machines	PCC	30	70	100	3	1	-	4
BTMEPCC405	Manufacturing Processes	PCC	30	70	100	3	-	-	3
BTMEPCC406	Theory Of Machines	PCC	30	70	100	3	1	-	4
BTMEVAC407	Facility planning & material handling	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC408	I C Engine Lab	LC	60	40	100	-	-	1	1
BTMEPCC409	Fluid Mechanics Lab	LC	60	40	100	-	-	1	1
BTMEPCC410	Production Practice Lab	LC	60	40	100	-	-	1	1
BTMEPCC411	Theory Of Machine Lab	LC	60	40	100	-	-	1	1
BTMEHSMC 412	Social Outreach, Discipline & Extra Curricular Activates	HSMC	100	-	100	-	-	-	1
TOTAL			**550**	**650**	**1200**	19	**2**	**4**	26

Semester-V

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC501	Mechatronics Systems	PCC	30	70	100	3	-	-	3
BTMEPCC502	Heat Transfer	PCC	30	70	100	3	-	-	3
BTMEPCC503	Manufacturing Technology	PCC	30	70	100	3	-	-	3
BTMEPCC504	Design Of Machine Elements I	PCC	30	70	100	3	-	-	3
BTMEPCC505	Manufacturing Automation	PCC	30	70	100	3	-	-	3
BTMEHSMC506.A	Industrial Psychology	HSMC (**Elective I)**	30	70	100	3	-	-	3
BTMEHSMC506.B	Operations Research								
BTHSMC 507	Professional Skills	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC508	Mechatronics Lab	LC	60	40	100	-	-	1	1
BTMEPCC509	Heat Transfer Lab	LC	60	40	100	-	-	1	1
BTMEPCC510	Production Engineering Lab	LC	60	40	100	-	-	1	1
BTMEPCC511	Machine Design Practice Lab	LC	60	40	100	-	-	1	1
BTMEPROJ512	Industrial Training/ Seminar	PRJ	60	40	100	-	-	1	1
BTMEHSMC 513	Social Outreach, Discipline & Extra Curricular Activates	HSMC	100	-	100	-	-	-	1
TOTAL			**610**	**690**	**1300**	**20**	**0**	**5**	**26**

Semester - VI

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC601	Measurement & Metrology	PCC	30	70	100	3	-	-	3
BTMEPCC602	Computer Aided Design & Analysis	PCC	30	70	100	3	-	-	3
BTMEPCC603	Mechanical Vibrations	PCC	30	70	100	3	-	-	3
BTMEPCC604	Design of Machine Elements II	PCC	30	70	100	3	-	-	3
BTMEPCC605	Research Methodology	PCC	30	70	100	3	-	-	3
BTMEHSMC606.A	Project Management	HSMC (**Elective II**)	30	70	100	3	-	-	3
BTMEHSMC606.B	Finance & Accounting								
BTMEVAC607	Robotics And Automation	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC608	Metrology Lab	LC	60	40	100	-	-	1	1
BTMEPCC609	Vibration Lab	LC	60	40	100	-	-	1	1
BTMEPCC610	Machine Design Practice II Lab	LC	60	40	100	-	-	1	1
BTMEPCC611	Thermal Engineering Lab	LC	60	40	100	-	-	1	1
BTMEPROJ612	Engineering Project-1 (Literature Review)	PROJ	60	40	100	-	-	2	2
BTMEHSMC 613	Social Outreach, Discipline & Extra Curricular Activates	HSMC	100	-	100	-	-	-	1
TOTAL			**610**	**690**	**1300**	**20**	**0**	**6**	**27**

Semester - VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPEC701.A	RAC	Professional Elective I	30	70	100	3	-	-	3
BTMEPEC701.B	Power Plant Engineering								
BTMEPEC702.A	Additive Manufacturing	Professional Elective II	30	70	100	3	-	-	3
BTMEPEC702.B	Finite Element Analysis								
BTMEOEC703.A	CIMS	Open Elective I	30	70	100	3	-	-	3
BTMEAOEC703.B	Power Generation Sources								
BTMEOEC704.A	Industrial Engineering	Open Elective II	30	70	100	3	-	-	3
BTMEOEC704.B	Non-Destructive System								
BTMEPCC705	Production & Operation Management	PCC	30	70	100	3	-	-	3
BTMEHSMC 706	Leadership & Management Skills	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC707	Industrial Engineering Lab	LC	60	40	100	-	-	1	1
BTMEAPCC708	RAC Lab	LC	60	40	100	-	-	1	1
BTMEAPCC709	CIMS Lab	LC	60	40	100	-	-	1	1
BTMEPROJ710	Industrial Training	PROJ	60	40	100	-	-	2	2
BTMEPRJ711	Engineering Project-2 (Design & Analysis)	PROJ	60	40	100	-	-	2	2
BTMEHSMC 712	Social Outreach, Discipline & Extra Curricular Activity	HSMC	100	-	100	-	-	-	1
TOTAL			**580**	**620**	**1200**	**17**	**0**	**7**	**25**

Semester - VIII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPEC801.A	Automobile Engineering	Professional Elective III	30	70	100	3	-	-	3
BTMEPEC801.B	Renewable Energy Engineering								
BTMEOEC802.A	Product Innovation & Entrepreneurship	Open Elective III	30	70	100	3	-	-	3
BTMEOEC802.B	Energy Management								
BTMEOEC802.C	Waste and By-product Utilization								
BTMEOEC802.D	Medium And Small Enterprises Management								
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC803	FEA Lab	LC	60	40	100	-	-	1	1
BTMEPCC804	Automobile Engineering Lab	LC	60	40	100	-	-	1	1
BTMEPROJ805	Engineering Project-3 (Testing & Prototype)	PROJ	120	80	200	-	-	4	4
BTMEHSMC 806	Social Outreach, Discipline & Extra	HSMC	100	-	100	-	-	-	1
TOTAL			**400**	**300**	**700**	**6**	**0**	**6**	**13**

Note:

- A student is required to obtain min. 40% marks in individual paper to pass.
- The total credit of B.Tech. (ME) Programme is 189. However, the minimum credit required for award of degree shall be 183.
- The credit relaxation will be applicable only on the elective course from different semester (i.e. the student can opt out only elective subject).

10. COURSE-WISE LEARNING OBJECTIVES, STRUCTURES AND OUTCOMES (CLOSOs)

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	BSC	30	70	100	3	1	-	4
BTBSC102A/ BTBSC102B	Engineering Physics/ Engineering Chemistry	BSC	30	70	100	3	1	-	4
BTHSMC103	Communication Skills	HSMC	30	70	100	2	-	-	2
BTESC104	Programming for Problem Solving	ESC	30	70	100	3	-	-	3
BTESC 105A/ BTESC 105B	Basic Civil Engineering/ Basic Electrical Engineering	ESC	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC106A/ BTBSC106B	Engineering Physics Lab/ Engineering Chemistry Lab	LC	60	40	100	-	-	1	1
BTHSMC107	Language Lab	LC	60	40	100	-	-	1	1
BTESC108	Computer Programming Lab	LC	60	40	100	-	-	1	1
BTESC 109A / BTESC 109B	Basic Civil Engineering Lab/ Basic Electrical Engineering Lab	LC	60	40	100	-	-	1	1
BTESC110	Computer Aided Engineering Graphics	LC	60	40	100	-	-	1	1
BTHSMC111	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	Total		**550**	**550**	**1100**	**14**	**2**	**5**	**22**

BTBSC101: Engineering Mathematics-I

Course Objectives:

- To achieve conceptual understanding and to retain the best traditions of traditional calculus.
- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions. \
- To familiarize the prospective engineers with techniques in calculus, multivariate analysis and differential equations.
- To equip the students with standard concepts and tools at an intermediate to advanced level

Course Content:

Unit I: **Single-variable Calculus (Differentiation):** (6 hours)
Rolle's Theorem, Mean value theorems and applications; Extreme values of functions; Linear approximation; Indeterminate forms and L' Hospital's rule. Curvature, evolutes and involutes

.

Unit II: **Multivariable Calculus (Differentiation):** (8 hours)
Limit, continuity and partial derivatives, directional derivatives, gradient, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

Unit III: **Sequences and series:** (10 hours)
Limits of sequence of numbers, Calculation of limits, Infinite series; Tests for convergence; Power series, Taylor and Maclaurin series; Taylor theorem, convergence of Taylor series, error estimates.

Unit IV: **Basic Calculus:** (6 hours)
Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit V: **Multivariable Calculus (Integration):** (10 hours)
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Gradient, curl and divergence, Theorems of Green, Gauss and Stokes.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edit ion, John Wiley & Sons,2006. F201
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,

Course Outcomes:

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

CO1: Know the applications of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO2: Apply the Concepts of the differential calculus

CO3: Understand and apply the concept of sequence and series.

CO4: Understand and apply the concept of Beta and Gamma functions.

CO5: Understand the calculation and Applications of Multivariable integrals.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO4,CO5

BTBSC102A: Engineering Physics

Course Objective:

- To understand the concepts of interference, Diffraction and Polarization.
- To know about wave particle duality.
- To know applications of Optical fibre.
- To know applications of Lasers in Science, engineering and medicine.
- To know classification of Solid.

Course Content:

Unit I: Wave Optics

Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.

Unit II: Quantum Mechanics

Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.

Unit III: Coherence and Optical Fibers

Spatial and temporal coherence: Coherence length; Coherence time and 'Q' factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

Unit IV: Laser

Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.

Unit V: Material Science & Semiconductor Physics

Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi dirac distribution function and Fermi energy,

Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.

References:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

Course Outcomes:

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

CO1: Enhance the basic skills required to understand, develop, and design various engineering applications involving Wave Optics.

CO2: Understand Quantum Mechanics and apply them to diverse engineering problems.

CO3: Analyze the nature of light propagation in guided medium for engineering applications and study in Coherence and Optical Fibers.

CO4: Describe different Laser problems.

CO5: Describe Material Science & Semiconductor Physics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	-	H	-	M	-	-	-	-	L	H	M
CO2	L3	H	H	H	H	-	M	-	-	-	-	-	-	M	M
CO3	L4	M	L	M	-	L	-	L	-	-	-	-	-	H	H
CO4	L2	H	M	H	H	M	-	M	L	-	L	-	L	H	M
CO5	L2	H	M	H	H	M	-	M	L	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO1, CO2, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTBSC102B: Engineering Chemistry

Course Objective:

- To acquire the knowledge about impurities in water, their determination and purification.
- To learn about different types of fuel and lubricant and their applications.
- To gain the basic knowledge, applications and control methods of corrosion.
- To get the knowledge of preparation and significance of explosives, cement, refractories and glass.
- To get the knowledge of organic reaction mechanism and their uses with different types of drugs

Course Contents:

Unit I: Water

Common impurities, hardness, determination of hardness by complexometric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process. Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.

Unit II: Organic Fuels

Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Unit III: Corrosion and its control

Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit IV: Engineering Materials

Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification,

Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

Unit V: Organic reaction mechanism and introduction of drugs

Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol

Suggested Text / Reference Books

1. Morrison R.T & Boyn R. N ; Organic Chemistry; Prentice Hall of India 1999
2. Lee J. D. ; Inorganic Chemistry ;Blackwell Science
3. Gopalan R., Venkappayya D., Nagarajan S. “Engineering Chemistry” Vikas Publishing House Pvt Ltd 2000.
4. Jain & Jain “ Engineering Chemistry” Dhanpat Rai publishing company
5. Dara S. S. , “ A Text Book of Engineering Chemistry” S. Chand and Company Ltd, 2008
6. Keeler J and Wolhess P, Why Chemical Reaction Happen Oxford Press.

Course Outcomes:

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

CO1: Gain knowledge about impurities in water, their determination and purification.

CO2: Understand organic fuels and various emerging new areas of organic chemistry.

CO3: Learn about Corrosion and its control.

CO4: Get knowledge about the chemistry of some Engineering Materials like Portland Cement.

CO5: Understand and study Organic reaction mechanisms.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	-	M	-	-	-	-	-	-	M	-	H	M	M
CO2	L2	M	-	-	-	L	-	-	-	-	L	-	M	M	M
CO3	L1	M	-	-	-	-	-	-	-	-	L	-	M	M	L
CO4	L2	M	-	-	-	-	-	-	-	-	L	-	M	H	M
CO5	L2	M	-	-	-	-	-	-	-	-	-	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO5

BTHSMC103: Communication Skills

Course Objectives:

- To identify common communication problems that may be holding learners back
- To perceive what the non-verbal messages are communicating to others
- To understand the role of communication in the teaching-learning process
- To learn to communicate through the digital media
- To understand the importance of empathetic listening
- To explore communication beyond language.

Course Content:

Unit I: Listening & Speaking

Listening: Techniques of Effective Listening, Listening and Comprehension, Probing Questions, Barriers to Listening

Speaking: Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors

Unit II: Reading, Writing and Different Modes of Writing

Reading: Techniques of Effective Reading, Gathering Ideas and Information from a Given Text, Evaluating these Ideas and Information, Interpreting the Text

Writing and Different Modes of Writing: The Writing Process, Effective Writing Strategies, Different Modes of Writing

Unit III: Digital Literacy and Social Media

Basic Computer Skills: Introduction to Microsoft (MS) Office Suite, Open Educational Resources

Basic Virtual Platforms

Trending Technologies: Machine Learning, Artificial Intelligence (AI), Internet of Things (IoT)

Social Media: Introduction to Social Media Websites, Advantages of Social Media, Ethics and Etiquettes of Social Media, How to Use Google Search Better, Effective Ways of Using Social Media

Digital Marketing: Introduction to Digital Marketing, Traditional Marketing versus Digital Marketing, Digital Marketing Tools, Social Media for Digital Marketing, Digital Marketing Analytics

Unit IV: Digital Ethics and Cyber Security

Digital Ethics: Digital Literacy Skills, Digital Etiquette, Digital Life Skills

Cyber Security: Understanding and introducing the environment of security, Types of attacks and attackers, The art of protecting secrets

Unit V: Non-Verbal Communication

Meaning of nonverbal communication, Advantages of using nonverbal communication, Introduction to modes of nonverbal communication: Open and Closed body language, Eye contact and Facial expression, Hand gestures. Do's and Don'ts in NVC, Learning from experts, Activities-based learning

Reference Books:

1. Ahmed, R. (2015. June 18). Five essential listening skills for English learners. British Council. https://www.britishcouncil.org/voices-magazine/five-essential-listening-skills-englishlearners

2. Skills You Need. (n.d.). Barriers to Effective Listening. Skills You Need. https://www. skillsyouneed.com/ips/ineffective-listening.html

3. Weiler, A. (2017. October 7). How to Improve English Pronunciation. Strategies in language learning. https://www.strategiesinlanguagelearning.com/how-to-improve-englishpronunciation/
4. Kirkham, L. (2022. February 16). How to Enunciate. Wiki how. https://www.wikihow.com/Enunciate
5. Literary Devices. (n.d.). Context. Literary Devices. https://literarydevices.net/context/
6. Bailey, Stephen. 2010. Academic Writing: A Handbook for International Learners. Routledge
7. Sherman. (2021, February 2). What is Digital Marketing? Here's Everything You Need to Know. Lyfe Marketing. https://www.lyfemarketing.com/blog/what-is-digital-marketing/
8. Loewus, L. (2016. November 8). What is Digital Literacy? Education Week. https://www. edweek.org/teaching-learning/what-is-digital-literacy/2016/11
9. Nordquist, R. (2020, June 29). What is Nonverbal Communication? Thought Co. https:// www.thoughtco.com/what-is-nonverbal-communication-1691351

Course Outcomes:

CO1 Utilize active listening in communication and use appropriate language to communicate their thoughts and ideas clearly

CO2 Utilize the reading skill to gain additional knowledge and confidence to improve speaking and writing abilities with use effective strategies for writing in different modes of writing.

CO3 Use digital literacy in their professional life for communication. Apply basic functionalities of trending technologies like machine learning, artificial intelligence, and IoT. Demonstrate the effectiveness of digital marketing for business and using the tools to reach a global audience.

CO4 Use ethical digital behaviours. Use practices that incorporate transparency, responsibility, and accountability. Assess the current security landscape, including the nature of the threat and the general status of common vulnerabilities. Identify core networking and infrastructure components, and the roles they serve in preparing a secured system.

CO5 Realize the importance of nonverbal communication. Use nonverbal communication effectively in communication as an aid.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Bloom's Levels**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	-	**L**	-	-	-	-	-	-	-	**H**	-	**H**	-	-
CO2	L3	-	-	-	-	-	-	-	-	-	**H**	-	**M**	-	-
CO3	L3	-	**L**	-	-	**M**	-	-	-	-	**H**	-	**M**	-	-
CO4	L2	-	-	-	-	**L**	-	-	**L**	**L**	**H**	-	**M**	-	-
CO5	L3	-	**L**	-	-	**L**	-	-	-	-	**M**	-	**M**	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4
CD5	Industrial visit	CO5

BTESC104: Programming for Problem Solving

Course Objective:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

Course Contents:

Unit I: **Fundamentals of Computer:**
Stored program architecture of computers, Storage device- Primary memory, and Secondary storage, Random, Direct, Sequential access methods.

Unit II: Concepts of High-level, Assembly and Low-level languages, Representing algorithms through flowchart and pseudo code.

Unit III: **Number system:**
Data representations, Concepts of radix and representation of numbers in radix r with special cases of r=2, 8, 10 and 16 with conversion from radix r1 to r2, r's and (r-1)'s complement, Binary addition, Binary subtraction, Representation of alphabets.

Unit IV: **C Programming:**
Problem specification, flow chart, data types, assignment statements, input output statements, developing simple C programs, If statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement.

Unit V: **Development of C programs using**
Arrays, functions, parameter passing, recursion, Programming in C using these statements, Structures, files, pointers and multi file handling.

Text / Reference Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes:

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

CO1: Know and understand the conventions of Fundamentals of Computer.

CO2: Represent algorithms through flowchart and pseudo code.

CO3: Learn Number system and apply these skills in developing new products.

CO4: Understand and learn C Programming.

CO5: Comprehend the Development of C programs using- Arrays, functions.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	M	-	M	L	-	-	-	-	-	L	H	M
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L3	H	L	M	L	M	L	-	-	-	L	-	L	H	H
CO4	L2	M	H	L	M	H	-	-	-	-	M	-	M	H	M
CO5	L2	M	H	H	M	H	-	-	-	-	M	-	M	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTESC105A: Basic Civil Engineering

Course Objective:

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

Course Contents:

Unit I: Introduction to objective, scope and outcome the subject

Basic Knowledge of Concrete , Mortar , R.C.C , P.C.C , Grade of Concrete, Masonry , Map Scale , Indian Standard Codes etc

Unit II: Scope and Specialization

Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Unit III: **Surveying** Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying,Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling: Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

Unit IV: Buildings

Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Unit V: Transportation

Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.

Text Books:

1. Gopi, S., Basic Civil Engineering, Pearson Publishers
2. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
3. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
4. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

References Books:

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
3. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
4. Minu, S., Basic Civil Engineering, Karunya Publications

Course Outcomes:

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

CO1: Illustrate the fundamental aspects of Civil Engineering.

CO2: Understand the scope of civil engineering.

CO3: Explain the concepts of surveying for making horizontal and vertical measurements.

CO4: Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.

CO5: Understand the modes of Traffic and Road Safety and Road Safety Measures

Course Delivery methods:

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	-	-	-	-	M	L	-	-	-	-	M	M	M
CO2	L2	H	M	M	L	-	M	L	-	-	L	-	L	M	M
CO3	L2	M	H	M	L	H	-	H	-	-	L	-	L	L	L
CO4	L2	M	H	M	L	H	-	H	-	-	L	-	L	M	M
CO5	L2	M	M	L	H	M	L	-	H	-	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO5
CD5	Industrial visit	CO3, CO4, CO5

BTESC105B: Basic Electrical Engineering

Course Objective:

- To understand the basic concept of Electrical engineering instruments for engineering applications.
- To understand the basic electrical engineering parameters and their importance.
- To understand the concept of various laws and principles associated with electrical systems.
- To develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

Course Contents:

Unit I: DC Circuits:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Series-Parallel circuits, Node voltage method, Mesh current method, Superposition, Thevenin's, Norton's and Maximum power transfer theorems.

Unit II: AC Circuits:

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

Unit III: Transformers:

Ideal and practical transformer, EMF equation, equivalent circuit, losses in transformers, regulation and efficiency.

Unit IV: Electrical Machines:

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Starting and speed control of induction motor, single phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited DC motor. Construction and working of synchronous generators.

Unit V: Power Converters:

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits of single phase rectifier with R load, Single phase Inverter, DC-DC converter.

Suggested Text / 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.
4. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Course Outcomes:

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

CO1: Apply basic skills for designing various instruments for engineering applications.

CO2: Determine error in laboratory measurements and techniques used to minimize such error.

CO3: Gain knowledge regarding the various laws and principles associated with electrical systems.

CO4: Understand electrical machines and apply them for practical problems.

CO5: Understand the concepts in the field of electrical engineering, projects and research.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L5	L	M	H	M	L	-	-	-	-	M	-	M	M	M
CO3	L1	M	H	H	H	-	-	-	-	-	H	-	M	M	M
CO4	L2	H	L	M	L	-	-	-	-	-	L	-	L	H	M
CO5	L2	M	H	H	H	-	-	-	-	-	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4, CO5
CD5	Industrial visit	CO5

BTBSC106A: Engineering Physics Lab

Course Objective:

- To understand the concepts of interference.
- To know about wavelength of light.
- To know about depletion layer and band gap of semiconductor.
- To know dispersion of light through prism.
- To understand the concept of magnetic field.

LIST OF EXPERIMENTS:

1. To determine the wave length of sodium light by Newton's Ring.
2. To determine the wave length of monochromatic light with the help of Fresnel's Bi prism.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
7. To study the charge and discharge of a condenser and hence determine the time constant for which both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fiber.
10. To study the variation of magnetic field at the center of coil using tangent galvanometer.

Course Outcomes:

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

CO1: Understand the usage of common Ammeter, Voltmeter and Multimeter.

CO2: Deep learning of optical phenomenon such as Interference, diffraction and dispersion of light.

CO3: Understand the usage of common electrical measuring instruments.

CO4: Gain knowledge about the concept of optical fiber and Laser.

CO5: Understand the usage of optical instruments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	-	H	-	M	-	-	H	-	L	H	L
CO2	L4	H	H	-	H	-	M	-	-	-	-	-	-	M	M
CO3	L2	M	L	-	-	L	-	L	-	-	L	-	-	M	L
CO4	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M
CO5	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO1,CO2, CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTBSC106B: Engineering Chemistry Lab

Course Objective:

- To understand the method for the determination of hardness in water and purification process.
- To understand about different types of volumetric analysis.
- To learn about properties of lubricant oil.
- To Synthesize a small drug molecule and analysis a salt sample

List of Experiments:

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O7 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
7. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

Course Outcomes:

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

CO1: Understand the method for the determination of hardness in water and purification process.

CO2: Understand about different types of volumetric analysis.

CO3: Learn about properties of lubricant oil.

CO4: Synthesize a small drug molecule and analyse a salt sample

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	M	-	M	-	-	L	-	-	M	-	-	M	L
CO2	L1	L	H	M	H	-	-	L	-	-	H	-	-	M	M
CO3	L1	M	L	H	L	L	-	M	-	-	L	-	L	M	M
CO4	L3	L	L	H	L	L	-	L	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4

BTHSMC107: Language Lab

Course Objective:

- To understand concepts of basic English language fundamentals.
- To understand the communication skills.
- To develop Dialogue Writing and Listening comprehension.

Syllabus

1. Phonetic Symbols and Transcriptions.
2. Extempore.
3. Group Discussion.
4. Dialogue Writing.
5. Listening comprehension.

Course Outcomes:

At the end of the course, the student will be able to:
CO1: understand the Phonetic Symbols and Transcriptions.
CO2: Understand the skills required in Extempore.
CO3: improve their communication skills for Group Discussion.
CO4: improve their technical communication skills.
CO5: Understand Dialogue Writing and Listening skills.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	-	-	-	H	M	-	-	-	H	-	M	H	M
CO2	L2	M	-	-	-	-	M	-	-	H	H	-	L	M	L
CO3	L6	M	-	-	-	-	M	-	-	H	H	-	M	M	L
CO4	L6	M	-	-	-	M	M	-	-	-	H	-	M	M	M
CO5	L2	M	-	-	-	M	M	-	-	M	H	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	-

BTESC 108: Computer Programming Lab

Course Objective(s):

- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

LIST OF EXPERIMENTS :

1. To learn about the C Library, Preprocessor directive, Input-output statement.
2. Programs to learn data type, variables, If-else statement
3. Programs to understand nested if-else statement and switch statement
4. Programs to learn iterative statements like while and do-while loops
5. Programs to understand for loops for iterative statements
6. Programs to learn about array and string operations
7. Programs to understand sorting and searching using array
8. Programs to learn functions and recursive functions
9. Programs to understand Structure and Union operation
10. Programs to learn Pointer operations
11. Programs to understand File handling operations
12. Programs to input data through Command line argument

Course Outcomes:

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

CO1: Learn about the C Library, Preprocessor directive, Input-output statement.

CO2: Learn data type, variables, and conditional statement.

CO3: Learn about array and string operations.

CO4: Understand File handling operations.

CO5: learn programs related to C Programming and apply them to solve real world problems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	-	-	M	L	-	-	-	L	-	L	M	L
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L2	H	L	M	L	M	L	-	-	-	L	-	L	H	M
CO4	L2	M	H	L	M	H	L	L	-	-	L	-	M	H	M
CO5	L3	M	H	H	M	H	M	L	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC 109A: Basic Civil Engineering Lab

Course Objective(s):

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

LIST OF EXPERIMENTS:

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of line using Surveyor's and Prismatic compass
3. Leveling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile leveling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

Course Outcomes:
At the end of the course, the student will be able to:
CO1: Conduct survey and collect field data.
CO2: Review field notes from survey data.
CO3: Interpret survey data and compute areas and volumes.
CO4: Describe Total station and measurement
CO5: Describe various water fittings and find out the various fluids properties

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	L	L	L	H	M	L	-	L	L	-	M	H	M
CO2	L2	H	M	M	M	-	M	L	-	L	M	-	L	M	L
CO3	L4	M	H	M	H	H	M	H	-	L	H	-	L	L	H
CO4	L2	M	H	M	H	H	M	H	-	L	H	-	L	-	M
CO5	L2	M	M	L	H	M	M	-	-	L	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC 109B: Basic Electrical Engineering Lab

Course Objectives:

- To understand training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

List of Experiments

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on an oscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three - phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate or brush arrangement), induction machine (squirrel cage rotor), synchronous (field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Course Outcomes:

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

CO1. Adapt knowledge regarding the various laws and principles associated with electrical systems.

CO2: Adapt knowledge regarding electrical machines and apply them for practical problems.

CO3: Understand various types' Electrical Equipments.

CO4: Understanding digital measuring equipments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	M	-	-	-	-	M	-	L	H	M
CO2	L3	L	M	H	M	M	-	-	-	-	M	-	M	M	M
CO3	L2	M	H	H	H	M	-	-	-	-	H	-	M	H	H
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	

BTESC110: Computer Aided Engineering Graphics

Course Objectives:

- To Increase ability to communicate with people
- To Learn to sketch and take object dimensions.
- To Learn to take data and transform it into graphic drawings.

Course Contents:

Introduction: Principles of drawing, lines, type of lines, usage of Drawing instruments, lettering, Conic sections including parabola, hyperbola, Rectangular Hyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

Projections of Point & Lines: Position of Point, Notation System, Systematic Approach for projections of points, front view & Top view of point, Position of straight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs, Line inclined to one RP and parallel to the other, Line inclined to Both the RPs, Traces of a line (One drawing sheet, one assignment in sketch book).

Projection of Planes: Positions of planes, Terms used in projections of planes, plane parallel to RP, plane inclined to one RP and perpendicular to the other RP, plane perpendicular to Both the RPs, plane Inclined to Both the RPs, True shape of the plane, Distance of a point from plane, Angle between two planes.

Projections of Regular Solids: frustum and truncated solids, those inclined to both the Planes-Auxiliary Views.

Section of Solids: Theory of sectioning, section of prisms and cubes, section of pyramids and Tetrahedron section of Cylinders, section of cones, section of spheres (One drawing sheet, one assignment in sketch book)

Overview of Computer Graphics: Covering theory of CAD software [such as: The menu System, Toolbars (standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of lines, Planes, Simple and compound Solids.

Course Outcomes:

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

CO1: Know and understand the conventions and the method of engineering drawing.

CO2: Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.

CO3: Know the Theory of sectioning and Section of Solids.

CO4: Comprehend the theory of projection.

CO5: Improve their drawing skill in the form of Computer Graphics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	L	M	L	L	-	-	L	M	-	L	L	M
CO2	L4	H	M	L	M	L	L	-	-	-	M	-	L	L	M
CO3	L1	H	M	L	M	L	L	-	-	L	M	-	L	L	L
CO4	L2	H	H	M	H	L	L	-	-	L	H	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	CO5

BTHSMC111: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

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

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	Engineering Mathematics-II	BSC	30	70	100	3	1	-	4
BTBSC202A/ BTBSC202B	Engineering Chemistry / Engineering Physics	BSC	30	70	100	3	1	-	4
BTHSMC203	Universal Human Values	HSMC	30	70	100	2	-	-	2
BTESC204	Basic Mechanical Engineering	ESC	30	70	100	2	-	-	2
BTESC205A/ BTESC205B	Basic Electrical Engineering/ Basic Civil Engineering	ESC	30	70	100	3	-	-	3
BTVAC206	Environment Studies	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC 207A/ BTBSC 207B	Engineering Chemistry Lab/ Engineering Physics Lab	LC	60	40	100	-	-	1	1
BTESC208	Manufacturing Practices Workshop	LC	60	40	100	-	-	1	1
BTESC209A/ BTESC209B	Basic Electrical Engineering Lab/ Basic Civil Engineering	LC	60	40	100	-	-	1	1
BTESC210	Computer Aided Machine Drawing	LC	60	40	100	-	-	1	1
BTHSMC 211	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	Total		**520**	**580**	**1100**	**16**	**2**	**4**	**22**

BTBSC 201: Engineering Mathematics-II

Course Objective:

- To provide detailed of matrices which is applied for solving system of linear equations and useful in various fields of technology.
- To understand and make use of the concepts of differential equations.
- To examine and analyze the complex function.
- To understand the numerical methods to find roots of the equations.

Course Content:

Unit-I: Matrices (10 hours)

Linear Systems of Equations; Linear Independence; Rank of a Matrix; Determinant, Inverse of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem, and quadratic to canonical forms.

Unit-II: Ordinary differential equations: (10 hours)

Exact, linear and Bernoulli's equations. Second order linear differential equations with Constant and variable coefficients. Power series solutions.

Unit-III: Partial differential equations: (8 hours)

Linear Partial differential equations of First order, Lagrange's Form, Non Linear Partial Differential equations of first order, Charpit's method, Standard forms. Separation of variables method to solve the simple problems in Cartesian coordinates.

Unit-IV: Complex Variable – Differentiation: (10 hours):

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, Conformal mappings, Mobius transformations. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (withoutproof), Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

Unit-V: Numerical Methods: (6 hours):

Roots of algebraic and transcendental equations using numerical methods as Bisection method, Regula-Falsi method, Newton-Raphson Method, Secant method.

Textbooks/References:

1. G.B.Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9thEdit ion, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.
8. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.

9. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005

Course Outcomes:

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

CO1: Understand the matrices and method for solving system of linear equations.

CO2: Solve the ODE differential.

CO3: Find the solutions of PDE.

CO4: Examine and analyze the complex functions and complex integrations and contour integrals.

CO5: Determine the roots of equations by numerical methods.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L2	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTBSC202A: Engineering Chemistry

Course Objective:

- To acquire the knowledge about impurities in water, their determination and purification.
- To learn about different types of fuel and lubricant and their applications.
- To gain the basic knowledge, applications and control methods of corrosion.
- To get the knowledge of preparation and significance of explosives, cement, refractories and glass.
- To get the knowledge of organic reaction mechanism and their uses with different types of drugs

Course Contents:

Unit I: Water

Common impurities, hardness, determination of hardness by complex metric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process. Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.

Unit II: Organic Fuels

Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Unit III: Corrosion and its control

Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit IV: Engineering Materials

Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by

tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

Unit V: Organic reaction mechanism and introduction of drugs

Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol

Suggested Text / Reference Books

1. Morrison R.T & Boyn R. N ; Organic Chemistry; Prentice Hall of India 1999
2. Lee J. D. ; Inorganic Chemistry ;Blackwell Science
3. Gopalan R., Venkappayya D., Nagarajan S. “Engineering Chemistry” Vikas Publishing House Pvt Ltd 2000.
4. Jain & Jain “ Engineering Chemistry” Dhanpat Rai publishing company
5. Dara S. S. , “ A Text Book of Engineering Chemistry” S. Chand and Company Ltd, 2008
6. Keeler J and Wolhess P, Why Chemical Reaction Happen Oxford Press.

Course Outcomes:

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

CO1: Gain knowledge about impurities in water, their determination and purification.

CO2: Understand organic fuels and various emerging new areas of organic chemistry.

CO3: Learn about Corrosion and its control.

CO4: Get knowledge about the chemistry of some Engineering Materials like Portland Cement.

CO5: understand and study Organic reaction mechanisms.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L2	H	-	M	-	-	-	-	-	-	M	-	H	M	M
CO2	L2	M	-	-	-	L	-	-	-	-	L	-	M	M	M
CO3	L1	M	-	-	-	-	-	-	-	-	L	-	M	M	L
CO4	L2	M	-	-	-	-	-	-	-	-	L	-	M	H	M
CO5	L2	M	-	-	-	-	-	-	-	-	-	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO5

BTBSC202B: Engineering Physics

Course Objective:

- To understand the concepts of interference, Diffraction and Polarization.
- To know about wave particle duality.
- To know applications of Optical fibre.
- To know applications of Lasers in Science, engineering and medicine.
- To know classification of Solid.

Course Contents:

Unit I: Wave Optics

Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.

Unit II: Quantum Mechanics

Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.

Unit III: Coherence and Optical Fibers

Spatial and temporal coherence: Coherence length; Coherence time and 'Q' factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

Unit IV: Laser

Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.

Unit V: Material Science & Semiconductor Physics

Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi Dirac distribution function and Fermi energy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.

References:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

Course Outcomes:

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

CO1: Enhance the basic skills required to understand, develop, and design various engineering applications involving Wave Optics.

CO2: Understand Quantum Mechanics and apply them to diverse engineering problems.

CO3: Analyze the nature of light propagation in guided medium for engineering applications and study in Coherence and Optical Fibers.

CO4: Describe different Laser problems.

CO5: Describe Material Science & Semiconductor Physics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	-	H	-	M	-	-	-	-	L	H	M
CO2	L3	H	H	H	H	-	M	-	-	-	-	-	-	M	M
CO3	L4	M	L	M	-	L	-	L	-	-	-	-	-	H	H
CO4	L2	H	M	H	H	M	-	M	L	-	L	-	L	H	M
CO5	L2	H	M	H	H	M	-	M	L	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO1, CO2, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTHSMC203: Universal Human Values

Objectives:

- To describe the meaning, purpose, and relevance of universal human values.
- To understand the importance of values in individual, social, career, and national life.
- To learn from the lives of great and successful people who followed and practised human values and achieved self-actualization.

Course Content:

Unit I: **Love and Compassion (Prem and Karuna):** What is love and its forms: love for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living. Love and compassion and inter-relatedness. Love, compassion, empathy, sympathy and non-violence, Individuals who are remembered in history for practicing compassion and love (such as the Buddha, and Jesus Christ). Narratives and anecdotes from history, literature, including local folklore. Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion? Sharing learner's individual and/or group experience(s). Simulated situations, Case studies.

Truth (Satya): What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others), Individuals who are remembered in history for practicing this value Narratives and anecdotes from history, literature including local folklore, Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it?, Learners' individual and/or group experience(s) Simulated situations, Case studies.

Unit II: **Non-Violence (Ahimsa): Introduction:** What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence, Ahimsa as non-violence and non killing, Individuals and organisations that are known for their commitment to nonviolence. Narratives and anecdotes about non-violence from history, and literature including local folklore, Practicing non-violence What will learners learn/gain if they practice nonviolence? What will learners lose if they don't practice it? , Sharing learner's individual and/or group experience(s) about non-violence.

Righteousness (Dharma): Introduction, What is righteousness. Righteousness and dharma, righteousness and propriety. Individuals who are remembered in history for practising righteousness. Narratives and anecdotes from history and literature, including local folklore. What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it? Sharing learners' individual and/or group experience(s). Simulated situations. Case studies.

Unit III: **Peace (Shanti):** Introduction, What is peace and its need? Peace, harmony and balance. Individuals and organizations that are known for their commitment to peace (Mahatma Gandhi, United Nations). Narratives and anecdotes about peace from history and literature including local folklore. What will learners learn/gain if they practice peace? What will learners lose if they don't practice it? Sharing the learner's individual and/or group experience(s) about peace. Simulated situations, Case studies.

Service (Seva): Introduction, What is service? Forms of service: for self, parents, spouse, family, friends, community, persons in distress, nation, humanity and other living and non-living things. Individuals who are remembered in history for practising this value. Narratives and anecdotes dealing with instances of service from history and literature including local folklore. What will learners learn or gain if they practice service? What will learners lose if they don't practice it? Sharing learner's individual and/or group experience(s) regarding service. Simulated situations, Case studies.

Unit IV: **Renunciation Sacrifice (Tyaga):** Introduction, What is renunciation? Renunciation and sacrifice. Greed is the main obstruction in the path of renunciation. Self-restraint and other ways of overcoming greed. Renunciation with action as true renunciation. Individuals who are remembered in history for practising this value like: Sri Rama, Bhishma, Gautama Buddha, Mahavira, Jesus Christ, Guru Govind Singh, Bhagat Singh, and Mahatma Gandhi. Narratives and anecdotes from history and literature, including local folklore about individuals who are remembered for their sacrifice and renunciation. What will learners learn/gain if they practice renunciation and sacrifice? What will learners lose if they don't practise it? Sharing learner's individual and/or group experience(s) Simulated situations, Case studies.

Unit V: **Constitutional Values, Justice, and Human Rights:**

Fundamental Values: Justice, Liberty, Equality, Fraternity, Human Dignity Fundamental Rights: Right to Life, Right to Freedom of Speech and Expression, Right to Education, Right to Health and Housing, Right to Work and Decent Living, Right against Exploitation

Fundamental Duties: Fundamental Duties of Indian Citizens (Article 51 A of the Constitution)

Patriotism, Pride and Gratitude for the Nation:

Reference Books:

1. Basham, A. L. (1954). The Wonder That Was India. London: Picador Press.
2. Basu, D. D. (2015). Workbook on the Constitution of India, Paperback Edition. Nagpur: Lexisnexis.
3. Ghosh, A. (1998). The Foundations of Indian Culture. Pondicherry: Sri Aurobindo Ashram.
4. Joshi, K. (1997). Education for Character Development. Delhi: Dharam Hinduja Centre of Indic Studies.
5. Milton, R. (1973). The Nature of Human Values. New York: The Free Press.
6. Preamble to The Constitution of India together with Articles 15, 16, 19-22, 23, 24, 26, 39, 51A.

Course Outcomes:

The learners shall be able to:

CO1 Become conscious practitioners of values.
CO2 Realize their potential as human beings and conduct themselves properly in the ways of the world.
CO3 Develop integral life skills with values
CO4 Inculcate and practice them consciously to be good human beings.
CO5 Realize their potential as human beings.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	L	-	H	L	-	-	H	-	-
CO2	L2	-	-	-	-	-	L	-	M	M	-	-	H	-	-
CO3	L3	-	-	-	-	-	M	-	H	L	-	-	H	-	-
CO4	L2	-	-	-	-	-	M	-	H	L	-		H	-	-
CO5	L3	-	-	-	-	-	M	-	H	L	-	-	H	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	

BTESC 204: Basic Mechanical Engineering

Course Objectives:

- To Increase ability to understand machine working
- To Learn to understand fundamentals of mechanical systems
- To Learn to make different mechanical aspects of engineering

Course Contents:

Unit I: Fundamentals:
Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology. Steam Boilers classification and types of steam boilers and steam turbines. Introduction and Classification of power plants.

Unit II: Pumps and IC Engines:
Applications and working of Reciprocating and Centrifugal pumps. Introduction, Classification of IC Engines, Main Components of IC Engines, Working of IC Engines and its components.

Unit III: Refrigeration and Air Conditioning:
Introduction, classification and types of refrigeration systems and air-conditioning. Applications of refrigeration and Air-conditioning.

Unit IV: Transmission of Power:
Introduction and types of Belt and Rope Drives, Gears.

Unit V: Primary Manufacturing Processes: Metal Casting Process: Introduction to Casting Process, Patterns, Molding, Furnaces. Metal Forming Processes: Introduction to Forging, Rolling, Extrusion, Drawing. Metal Joining Processes: Introduction to various types of Welding, Gas Cutting, Brazing, and Soldering.

Text Books:

- Agarwal C M, Agarwal Basant “Basic Mechanical Engineering” 2019

Reference Books

- Shanmugam G, Ravindran S “Basic Mechanical Engineering” TMH Publication , 2019
- Bansal R K “Basic Mechanical Engineering” Laxmi Publication 2019

Course Outcomes:

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

CO1: Know and understand the Fundamentals of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology.

CO2: Understand the Refrigeration and Air Conditioning.

CO3: Understand the Applications and working of Reciprocating and Centrifugal pumps.

CO4: Know the Transmission of Power through Belt and Rope Drives, Gears.

CO5: Understand of Primary Manufacturing Processes.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	M	L	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	L	L	L	M	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	L	L	L	-	L	-	-	L	-	L	M	M
CO5	L2	M	L	L	L	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3,
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTESC205A: Basic Electrical Engineering

Course Objective:

- To understand the basic concept of Electrical engineering instruments for engineering applications.
- To understand the basic electrical engineering parameters and their importance.
- To understand the concept of various laws and principles associated with electrical systems.
- To develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

Course Contents:

Unit I: DC Circuits:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Series-Parallel circuits, Node voltage method, Mesh current method, Superposition, Thevenin's, Norton's and Maximum power transfer theorems.

Unit II: AC Circuits:

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

Unit III: Transformers:

Ideal and practical transformer, EMF equation, equivalent circuit, losses in transformers, regulation and efficiency.

Unit IV: Electrical Machines:

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Starting and speed control of induction motor, single phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited DC motor. Construction and working of synchronous generators.

Unit V: Power Converters:

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits ofsingle phase rectifier with R load, Single phase Inverter, DC-DC converter.

Suggested Text / 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.
4. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Course Outcomes:

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

CO1: Apply basic skills for designing various instruments for engineering applications.

CO2: Determine error in laboratory measurements and techniques used to minimize such error.

CO3: Gain knowledge regarding the various laws and principles associated with electrical systems.

CO4: Understand electrical machines and apply them for practical problems.

CO5: Understand the concepts in the field of electrical engineering, projects and research.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L5	L	M	H	M	L	-	-	-	-	M	-	M	M	M
CO3	L1	M	H	H	H	-	-	-	-	-	H	-	M	M	M
CO4	L2	H	L	M	L	-	-	-	-	-	L	-	L	H	M
CO5	L2	M	H	H	H	-	-	-	-	-	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4, CO5
CD5	Industrial visit	CO5

BTESC205B: Basic Civil Engineering

Course Objective:

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

Course Contents:

Unit I: Introduction to objective, scope and outcome the subject

Unit II: Introduction

Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Unit III: **Surveying** Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying, Bearings and Longitude & Latitude of a Line, Introduction to total station. Leveling: Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

Unit IV: Buildings

Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Unit V: Transportation

Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.

TEXTBOOKS:

1. Gopi, S., Basic Civil Engineering, Pearson Publishers
2. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
3. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
4. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

References Books:

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
3. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
4. Minu, S., Basic Civil Engineering, Karunya Publications

Course Outcomes:

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

CO1: Illustrate the fundamental aspects of Civil Engineering.

CO2: Understand the scope of civil engineering.

CO3: Explain the concepts of surveying for making horizontal and vertical measurements.

CO4: Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.

CO5: Understand the modes of Traffic and Road Safety and Road Safety Measures

Course Delivery methods:

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	-	-	-	-	M	L	-	-	-	-	M	M	M
CO2	L2	H	M	M	L	-	M	L	-	-	L	-	L	M	M
CO3	L2	M	H	M	L	H	-	H	-	-	L	-	L	L	L
CO4	L2	M	H	M	L	H	-	H	-	-	L	-	L	M	M
CO5	L2	M	M	L	H	M	L	-	H	-	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO5
CD5	Industrial visit	CO3, CO4, CO5

BTVAC206: Environmental Studies

Course Objectives:

- To provide student with an understanding of the natural, human and social dimensions of local and wider environments.\
- To provide students with opportunities to engage in active learning
- To encourage students to use a wide range of skills, and acquire open, critical and responsible attitudes.

Course Contents:

Unit I Ecosystems and Biodiversity

Ecosystem – Introduction- Abiotic and Biotic components. Structure and functions of Ecosystem, Food Chain, Food web, Ecological pyramids, Energy flow and biogeochemical cycle, Biodiversity – Values, Type and levels of Biodiversity. Causes of depletion. Conservation of biodiversity.

Unit II Natural Resources and Environment

Forest resources: types and Values, Water resources: Types of water resources-fresh water and marine resources; Availability and use of water resources, Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation, Non-Conventional energy sources, Introduction, renewable sources of energy, Potential of renewable energy resources in India, solar energy, wind energy, Energy from ocean, energy from biomass, geothermal energy and nuclear energy.

Unit III Environmental Pollutions

Water Pollution – Sources of water, water quality standards, type of pollutants – its sources and effects, Air Pollution – composition of atmosphere, Air quality standards, Sources and adverse effects of air pollution, Greenhouse effect, global warming, acid rain, ozone depletion, Noise Pollution – Introduction, Level of noise, Sources and adverse effects of noise, Control of noise pollution.

Unit IV Environmental Management and Sustainable Development

Solid Waste Management, Municipal waste – Introduction, classification of solid waste, composition and characteristics of solid waste, Collection conveyance and disposal of solid waste, recovery of resources. Sanitary land filling, Vermi-composting, incineration, Biomedical waste – Generation, collection and disposal. Water Conservation, Rain Water Harvesting.

Unit V Social Issues and Environmental Legislation

Social Issues and Environmental Impact Assessment (EIA), Sustainable development, Public awareness and environmental education, Environmental Legislations in India – Environmental Protection act-1986, Air (Prevention and control of Pollution) act, water (Prevention and control of Pollution) act, wildlife protection act, Forest conservation act.

Suggested Readings

1. Bamanayha B.R., Verma, L.N. and Verma A (2005). Fundamentals of Environmental Sciences, Yash Publishing House, Bikaner.
2. Dhaliwal G.S., Sangha G.S. and Ralhan P.K. (2000) Fundamentals of Environmental Sciences,Kalyani Publishers, New Delhi.
3. Odum E.P. and Barrett G.W.(2007) Fundamentals of Ecology, Akash Press, New Delhi.
4. Agrawal, K.C.(1999) Environmental Biology, Agro Botanica, Bikaner.
5. Ranjeeta Soni, Environmental Studies and Disaster management" New India Publication Agency (NIPA), New Delhi.
6. Shikha Agarwal, Suresh Sahu, Environmental Engineering, Dhanpat Rai Publication.
7. M N Rao, HVN Rao ,Air Pollution,Tata Mcgraw Hill Education Private Limited.

Course Outcomes:

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

CO1: Understand the interdisciplinary branches of environment and their scopes. Ecosystem Links between environmental components and their role and types of ecosystems. Types of biodiversity, their values, depletion and various conservation methods.

CO2: Concepts and classification of natural resources. They will able to understand about biotic resources, soil and mineral resources, Concept of non Conventional energy resources, types and various applications of renewable resources and current potentials of energy resources.

CO3: Understand about various types of pollutions and their classification, types of pollutants and their sources. Various quality standards for pollutions, adverse health effects including air, water, soil, noise thermal and radioactive pollutions.

CO4: Basic knowledge about management system, cost benefit analysis, EIA and EA solid and hazardous waste management ,concept of 3Rs and Sustainable development Goals and strategies.

CO5: Basic knowledge about various constitutional acts, laws, agreements and about organizations on international level for environmental initiatives.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1,L2	M	-	-	-	-	--	H	-	-	-	-	H	-	-
CO2	L2,L4	M	-	-	-	-	-	H	-	-	-	-	H	-	-
CO3	L1,L4	M	-	-	-	-	L	H	-	-	-	-	H	-	-
CO4	L1,L2	M	-	-	-	-	-	H	-	-	-	-	H	-	-
CO5	L1,L2	M	-	-	-	-	L	H	-	-	-	-	H	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4

BTBSC207A: Engineering Chemistry Lab

Course Objective:

- To understand the method for the determination of hardness in water and purification process.
- To understand about different types of volumetric analysis.
- To learn about properties of lubricant oil.
- To Synthesize a small drug molecule and analyse a salt sample

List of Experiments:

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O7 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
7. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

Course Outcomes:

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

CO1: Understand the method for the determination of hardness in water and purification process.

CO2: Understand about different types of volumetric analysis.

CO3: Learn about properties of lubricant oil.

CO4: Synthesize a small drug molecule and analyse a salt sample

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	M	-	M	-	-	L	-	-	M	-	-	M	L
CO2	L1	L	H	M	H	-	-	L	-	-	H	-	-	M	M
CO3	L1	M	L	H	L	L	-	M	-	-	L	-	L	M	M
CO4	L3	L	L	H	L	L	-	L	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4

BTBSC 207B: Engineering Physics Lab

Course Objective:

- To understand the concepts of interference.
- To know about wavelength of light.
- To know about depletion layer and band gap of semiconductor.
- To know dispersion of light through prism.
- To understand the concept of magnetic field.

LIST OF EXPERIMENTS :

1. To determine the wave length of sodium light by Newton's Ring.
2. To determine the wave length of monochromatic light with the help of Fresnel's Biprism.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
7. To study the charge and discharge of a condenser and hence determine the time constant for which both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fibre.
10. To study the variation of magnetic field at the center of coil using tangent galvanometer.

Course Outcomes:

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

CO1: Understand the usage of common Ammeter, Voltmeter and Multimeter.

CO2: Deep learning of optical phenomenon such as Interference, diffraction and dispersion of light.

CO3: Understand the usage of common electrical measuring instruments.

CO4: Gain knowledge about the concept of optical fiber and Laser.

CO5: Understand the usage of optical instruments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	-	H	-	M	-	-	H	-	L	H	L
CO2	L4	H	H	-	H	-	M	-	-	-	-	-	-	M	M
CO3	L2	M	L	-	-	L	-	L	-	-	L	-	-	M	L
CO4	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M
CO5	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO1,CO2, CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC208: Manufacturing Practices Workshop

Course Objectives:

- To discuss the modules include training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

Carpentry Shop

1. T – Lap joint
2. Bridle joint

Foundry Shop

3. Mould of any pattern
4. Casting of any simple pattern

Welding Shop

5. Lap joint by gas welding
6. Butt joint by arc welding
7. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting

Machine Shop Practice

9. Job on lathe with one step turning and chamfering operations

Fitting and Sheet Metal Shop

10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metal
12. To cut a square notch using hacksaw and to drill a hole and tapping

Course Outcomes:

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

CO1: Describe cast different parts through Carpentry.

CO2: Define control manufacturing via computers.

CO3: Understanding use power tools and fitting tools.

CO4: Knowledge of various welding operations

CO5: Understanding different metallic and non-metallic objects.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	H	M
CO2	L2	H	M	L	M	M	-	-	-	-	M	-	L	M	L
CO3	L2	H	M	L	M	M	-	-	-	-	M	-	L	H	M
CO4	L2	H	M	L	M	M	-	L	-	L	M	-	L	H	M
CO5	L2	H	M	L	M	M	-	L	-	L	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTESC209A: Basic Electrical Engineering Lab

Course Objectives:

- To understand training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

List of Experiments

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on an oscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three - phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate or brush arrangement), induction machine (squirrel cage rotor), synchronous (field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Course Outcomes:

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

CO1. Adapt knowledge regarding the various laws and principles associated with electrical systems.

CO2: Adapt knowledge regarding electrical machines and apply them for practical problems.

CO3: Understand various types' Electrical Equipments.

CO4: Understanding digital measuring equipments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	M	-	-	-	-	M	-	L	H	M
CO2	L3	L	M	H	M	M	-	-	-	-	M	-	M	M	M
CO3	L2	M	H	H	H	M	-	-	-	-	H	-	M	H	H
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	

BTESC209B: Basic Civil Engineering Lab

Course Objective(s):

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

LIST OF EXPERIMENTS:

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of line susing Surveyor's and Prismatic compass
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

Course Outcomes:
At the end of the course, the student will be able to:
CO1: Conduct survey and collect field data.
CO2: Review field notes from survey data.
CO3: Interpret survey data and compute areas and volumes.
CO4: Describe Total station and measurement
CO5: Describe various water fittings and find out the various fluids properties

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	L	L	L	H	M	L	-	L	L	-	M	H	M
CO2	L2	H	M	M	M	-	M	L	-	L	M	-	L	M	L
CO3	L4	M	H	M	H	H	M	H	-	L	H	-	L	L	H
CO4	L2	M	H	M	H	H	M	H	-	L	H	-	L	-	M
CO5	L2	M	M	L	H	M	M	-	-	L	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC210: Computer Aided Machine Drawing

Course Objective:

- To design, develop and analyze simple linear and non linear computer based drawing.
- To identify and apply the suitable knowledge of computers to understand the shape and size of Drawing Objects.

Course Contents:

Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet) Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing view problems covering Principles of Orthographic Projections.

Sectional views of mechanical components: (1 drawing sheet) Introduction, cutting plane line, type of sectional views-full section, half section, partial or broken section, revolved section, removed section, offset section, sectioning conventions-spokes, web rib, shaft, pipes, different types of holes, conventions of section lines for different metals and materials.

Fasteners and other mechanical components: (Free hand sketch) Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc. Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, and pin type flexible coupling. Other components: Welded joints, belts and pulleys, pipes and pipe joints, valves etc.

Overview of Computer Graphics: (2 drawing sheets) Covering theory of CAD software such as: The menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (Where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple and compound Solids.

Course Outcomes:

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

CO1: Understand the conventions and the method of engineering drawing.

CO2: Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.

CO3: Adapt theory of sectioning and Section of Solids.

CO4: Classify the theory of projection.

CO5: Understand drawing skill in the form of Computer Graphics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	L	M
CO2	L4	H	L	H	L	L	-	-	-	-	L	-	L	L	L
CO3	L3	H	H	H	H	L	-	-	-	-	H	-	L	L	M
CO4	L4	H	M	H	M	L	-	-	-	L	M	-	L	M	L
CO5	L2	H	M	H	M	L	-	-	-	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	-----

BTHSMC211: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

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

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

SEMESTER: III

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEBSC301	Engineering Mathematics-III	BSC	30	70	100	3	-	-	3
BTMEESC302	Basic Electronics Engineering	ESC	30	70	100	3	-	-	3
BTMEESC303	Engineering Mechanics	ESC	30	70	100	3	1	-	4
BTMEPCC304	Engineering Thermodynamics	PCC	30	70	100	3	-	-	3
BTMEPCC305	Materials Science and Engineering	PCC	30	70	100	3	-	-	3
BTMEPCC306	Mechanics of Solids	PCC	30	70	100	3	1	-	4
BTMEHSMC307	Fundamentals of Indian Knowledge System	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC308	Machine drawing practice	LC	60	40	100	-	-	1	1
BTMEPCC309	Materials Testing Lab	LC	60	40	100	-	-	1	1
BTMEPCC310	Basic Mechanical Engineering Lab	LC	60	40	100	-	-	1	1
BTMEESC311	Basic Electronics Engineering Lab	LC	60	40	100	-	-	1	1
BTMEPROJ312	Industrial Training/Seminar	PROJ	60	40	100	-	-	-	1
BTMEHSMC 313	Social Outreach, Discipline & Extra Curricular Activates	HSMC	100	-	100			-	1
TOTAL			**610**	**690**	**1300**	**20**	**2**	**4**	**28**

BTMEBSC 301: Mathematics –III

Course Objective:

- To familiar with the Laplace transform techniques to solve differential equations.
- To familiar with the Fourier transform techniques.
- To familiar with the Z transform techniques
- To familiar with various Numerical techniques and apply them .
- To understand and apply the Linear Programming theory.

Course Content:

Unit-I: **Laplace Transform:** Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.

Unit-II: **Fourier Transform:** Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).

Unit-III: **Z-Transform:** Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation.

Unit-IV: **Numerical Methods:** Finite differences, Relation between operators,Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Unit-V **Linear Programming:** Simplex method, Two Phase Method and Duality in Linear Programming.

Textbooks:

1. Murray R. Spiegel, (1981), "Vector Analysis" Schaum Publishing Co.

2. Grewal B.S. (2006) "Higher Engg. Mathematics", Khanna Publishers, 39th Edition.

References Books:

1. Erwin Kre yszig (2006) "AdvanCEd Engg. Mathematics", Wiley Eastern Ltd. 8th Edition
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. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Course Outcomes:

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

CO1: Understand the Laplace transforms theory and use this theory to solve ordinary and partial differential equations
CO2: Understand the Fourier transforms theory and use this theory to solve ordinary and partial differential equations.
CO3: Understand the Z- transforms theory and use this theory to solve difference equations.
CO4: Understand and apply to solve various problems of science and engineering.
CO5: Understand the concept of Linear Programming theory.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTMEESC302: Basic Electronics Engineering

Course Objectives:

- To acquire the basic knowledge of digital logic levels and their application
- To prepare students to perform the analysis and design of various digital electronic circuits.

Course Contents:

Unit I **Introduction:** Objective, scope and outcome of the course. Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

Unit II **Operational amplifier and its applications:** Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

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

Unit IV **Digital Electronics Fundamentals:** Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

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

Reference/Suggested Books:

1. T.M. Floyd, R.P. Jain-Digital fundamentals, Pearson Education.
2. Morris and Mano - Digital logic and Computer Design, Prentice – Hall of India
3. R.P. JAIN: Modern Digital Electronics 4/e, TMH.
4. Kharate G K : Digital Electronics, Oxford
5. Pedroni -Digital Electronics & Design, ELSEVIER.
6. Balbir Kumar and Shail B.Jain, “Electronic Devices and Circuits” PHI,

Course Outcomes:

Upon completion of this course, students will be:

CO1: Understand different type of codes and number systems which are used in digital transmission and computer systems.

CO2: Apply the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.

CO3: Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.

CO4: Design different types of with and without memory element digital electronic circuits for particular operation, within the real time of economic, performance, efficiency, user friendly and environmental constraints.

CO5: Assess the nomenclature and technology in the area of various memory devices used and apply the memory devices in different types of digital circuits for real world application.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	L	-	-	-	L	M	-	L	M	M
CO2	L3	M	L	L	L	M	-	-	-	-	L	-	L	L	H
CO3	L4	H	L	L	L	-	-	-	-	-	L	-	L	M	M
CO4	L6	M	M	M	M	-	-	-	-	-	M	-	L	M	H
CO5	L5	M	L	L	L	M	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTMEESC303: Engineering Mechanics

Course Objectives:

- To learn a process for analysis of static objects
- To learn concepts of force, moment, and mechanical equilibrium;
- To analyze forces and moments in two and three dimensions;
- To analyze distributed forces and internal loads.
- To analyze forces in various systems such as frames, machines, trusses, beams and cables

Course Contents:

Unit I **Statics of particles and rigid bodies:**

Fundamental laws of mechanics, Principle of transmissibility, System of forces, Resultant force, Resolution of force, Moment and Couples, Varignon's theorem, Resolution of a force into a force and a couple, Free body diagram, Equilibrium, Conditions for equilibrium, Lami's theorem.

Plane trusses:

Types of structures, Trusses, Support Conditions, Types of Loadings, Classification of trusses, Determinacy of trusses, Basic assumptions of truss analysis, Method of joints, Method of sections. Virtual work: Principle of Virtual Work, Active forces and active force diagram, Stability of equilibrium.

Unit II **Centroid & Moment of inertia**:

Location of centroid and center of gravity, Moment of inertia, Parallel axis and perpendicular axis theorem, Radius of gyration, M.I of composite section, Polar moment of inertia, M.I of solid bodies.

Lifting machines: Mechanical advantage,

Velocity Ratio, Efficiency of machine, Ideal machine, Ideal effort and ideal load, Reversibility of machine, Law of machine, Lifting machines; System of pulleys, Simple wheel and axle, Wheel and differential axle, Weston's differential pulley block, Worm and worm wheel, Single purchase winch crab, Double purchase winch crab, Screw jack, Differential screw jack.

Unit III **Friction**: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction.

Belt and Rope drive:

Types of belts, Types of belt drives, Velocity ratio, Effect of slip on Velocity ratio, Crowing of pulleys, Length of belt, Ratio of tensions in flat belt drive, Power transmission by belt drives, Advantage and disadvantages of V-Belt over Flat Belt.

Unit IV **Kinematics:**

Fundamentals of rectilinear motion and curvilinear motion, applications of general equations, Projectiles motion on plane and on inclined plane, Concept of Relative motion.

Dynamics:

Principles of dynamics, D'Alembert's principle, conservation of momentum and energy, Work and Energy and impulse momentum methods, central impact, oblique impact, system of variable mass.

Unit V **Vibrations:**

Introduction to vibrations, Free vibrations of particles, Simple, compound and torsional pendulum, Energy Method.

Suggested Text / Reference Books

1. Vector Mechanics for Engineers, Beer and Johnston, Tata McGraw-Hill.
2. Engineering Mechanics, Hibbeler, Pearson Education.
3. Engineering Mechanics, Meriam and Kraige, John Wiley & Sons.
4. Engineering Mechanics, Timoshenko and Young, Tata McGraw-Hill.
5. Engineering Mechanics, Shames, Pearson Education.
6. Engineering Mechanics, Boresi and Schmidt, CL-Engineering.

Course Outcomes:

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

CO1: Use a standard process for analyzing static objects

CO2: Define a centroid & moment of inertia.

CO3: Apply forces and moments in two and three dimensions, and find a component of a frictional force

CO4: Apply the knowledge of kinematics and dynamics of bodies.

CO5: Use conditions of vibrations for stability of bodies.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	M	H	M	H	L	-	-	-	-	-	L	L	M
CO2	L2	H	M	M	M	-	-	-	-	-	L	-	M	M	M
CO3	L3	H	H	H	H	-	-	-	-	-	-	-	L	M	H
CO4	L3	H	H	M	H	H	-	-	-	-	L	-	L	H	L
CO5	L4	M	M	H	M	L	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTMEPCC304: Engineering Thermodynamics

Course Objectives:

- To learn about work & heat interactions, balance of energy between system and its surroundings
- To learn about various thermodynamic laws.
- To evaluate the changes in properties of substances in various processes
- To understand the difference between high grade and low grade energies and II law limitations on energy conversion.

Course Contents:

Unit I **Basic Concepts and definitions of Thermodynamics**: System, Surroundings, Property, Energy, Thermodynamic Equilibrium, Process, work and modes of work.

Zeroth and First Law of Thermodynamics: Zeroth of Thermodynamics**,** Temperature scale, First law of thermodynamics, First law analysis of some elementary processes. Steady and unsteady flow energy equations.

Unit II **Second Law of Thermodynamics:** Heat engine, Heat pump and refrigerator, Second law of thermodynamics, Equivalence of the Kelvin-Plank and Clausius statements. Reversible and Irreversible Processes, Carnot engine, Efficiency of a Carnot engine, Carnot principle, thermodynamic temperature scale, Clausius Inequality.

Entropy: Entropy, Calculation of Entropy change, Principle of entropy increase. Temperature-Entropy diagram, Second law analysis of a control volume.

Availability: Available energy, Loss in available energy, Availability Function, Irreversibility.

Unit III **Thermodynamic Properties of Fluids:** Pure substance, Concept of Phase, Graphical representation of p-v-T data, Properties of steam. Steam tables, Mollier chart

Ideal Gas and Real Gas: Ideal gas, Real gas, Internal energy, enthalpy and specific heats of an ideal gas, equations of state, Dalton's law of partial pressures, Gibbs Dalton law, Thermodynamic properties of gas mixtures.

Unit IV **Thermodynamic Relations:** Thermodynamic variables, Independent and dependent variables, Maxwell's thermodynamic relations, Thermodynamic relations involving entropy, Thermodynamic relations involving enthalpy and internal energy, Joule-Thomson coefficient, Clapeyron equation.

Power Cycles: Otto cycle, Diesel cycle, Dual cycle, Brayton cycle and Ericsson cycle.

Unit V **Vapour power cycle:** Rankine cycle, effect of operating conditions onits efficiency, properties of ideal working fluid in vapour power cycle Reheat cycle, regenerative cycle, bleeding extraction cycle, feed water heating co-generation cycle.

Suggested Text / Reference Books

1. Engineering Thermodynamics, Chottopadhyay P., Oxford University Press.
2. Thermal Science & Engineering, Kumar D.S., S.K. Kataria & Sons
3. Engineering Thermodynamics, Nag P.K., Tata McGraw-Hill, New Delhi
4. Fundamentals of Classical Thermodynamics, Gordan J Van Wylen, Willey Eastern Ltd.
5. Engineering Thermodynamics, Cengel & Boles, Tata McGraw-Hill, New Delhi.

Course Outcomes:

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

CO1: To Describe about work and heat interactions, and balance of energy between system and its surroundings.

CO2: To learn about application of I law to various energy conversion devices

CO3: To evaluate the changes in properties of substances in various processes

CO4: To understand the difference between high grade and low grade energies and II law limitations on energy conversion

CO5: To examine the condition of steam and performance of vapour power cycle and vapour compression cycle.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	M	L	L	-	-	-	-	-	L	M	M
CO2	L2	H	M	H	M	L	-	L	-	-	-	-	-	M	M
CO3	L5	H	H	H	H	L	-	-	-	-	-	-	L	M	M
CO4	L2	H	H	H	H	L	-	L	-	-	-	-	-	M	M
CO5	L4	M	M	H	M	L	-	-	-	-	-	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

MEPCC305: Materials Science and Engineering

Course Objectives:

- To understand the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
- To provide a detailed interpretation of equilibrium phase diagrams.

Course Contents:

Unit I Crystal structure – BCC, FCC and HCP, unit cell, crystallographic planes and directions, miller indices. Crystal imperfections, point, line, surface and volume defects.

Frank Reed source of dislocation, Elastic & plastic modes of deformation, Bauschinger's effect, slip & twinning, strain hardening, cold/hot working recovery, re-crystallization and grain growth.

Unit II Classification of Engineering Materials: Solidification of metals and of some typical alloys, mechanism of crystallization (I) nuclear formation(ii) crystal growth, general principles of phase transformation in alloys, phase rule and equilibrium diagrams, equilibrium diagram of binary system having complete mutual solubility in liquid state and limited solubility in solid state, binary isomorphous alloy system, Hume-Rothery rule , binary system with limited solid solubility of terminal phase and in which solubility decreases with temperature and also alloy with a peritectic transformation, equilibrium diagram of a system whose components are subject to allotropic change.

Iron carbon equilibrium diagram, phase transformation in the iron carbon diagram, eutectic, peritectic, eutectoid and peritectoid reactions and microstructures.

Unit III Isothermal transformation diagrams –cooling curves superimposed on Isothermal Transformation diagram, critical cooling rate. (i) Formation of Austenite from Pearlite (ii) Transformation of Austenite into Pearlite.

Full annealing, stress relief, spheroidizing – normalizing, hardening and tempering of steel. Hardenability, Jominey end quench test –Austempering, martempering. Case hardening, carburising, nitriding, cyaniding, carbonitriding. Flame and Induction hardening.

Unit IV Non-Metallic Materials- Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC,PMMA, PET, PC, PA, ABS, PI, PAI, PPO,PPS, PEEK, PTFE Polymers. Urea and Phenol formaldehydes.

Constitution of alloys: Solid solutions - substitutional and interstitial. Ferrous and Non Ferrous Metals- Effect of alloying additions on steel(Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA steel.

Unit V Mechanical Properties and Testing: Types of fracture, testing of materials under tension, compression and shear loads – hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test.

Classification of steels and cast iron constitution and properties. BIS standards. Engineering Ceramics – Properties and applications of Al2O3, SiC,Si3N4, PSZ etc. Fiber and particulate reinforced composites and resin plastics. Introduction to Nano materials- Nano structured materials. Nano clusters & Nano crystals.

Suggested Text / Reference Books:

1. An Introduction to Material Science and Engineering, William D.Callister, John Wiley and Sons.
2. Material Science, Raghvan V., Prentice Hall India.
3. Principles of Material Science and Engineering, William F.Smith, McGraw-Hill Publications.
4. Engineering Physical Metallurgy, Lakhtin Y., Mir Publisher.
5. Heat Treatment – Principles and Techniques, Rajan T.V., Sharma and Sharma, Prentice Hall of India.
6. The Structure, Properties and Heat treatment of Metals, Davies D.J. and Oelmann L.A., Pitman Books, London.

Course Outcomes:

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

CO1. Identify crystal structures for various materials and understand the defects in such structures

CO2. Understand material properties of mechanism of crystallization

CO3. Understand materials the Isothermal transformation

CO4. Define the different mechanical properties of material by studying different destructive and non- destructive testing.

CO5. Articulate and utilize corrosion prevention strategies and estimate corrosion behavior of materials and components

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	M	H	L	-	-	-	L	-	L	M	M
CO2	L2	H	M	H	M	M	-	-	-	-	L	-	L	M	M
CO3	L2	H	H	H	H	M	-	-	-	-	L	-	L	L	M
CO4	L1	H	H	H	H	H	-	-	-	-	L	-	L	L	M
CO5	L3	M	M	H	M	H	-	-	-	-	L	-	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO4, CO5

BTMEPCC306 : Mechanics of Solids

Course Objectives:

- To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads
- To calculate the elastic deformation occurring in various simple geometries for different types of loading

Course Contents:

Unit I **Stress and Strain:** Elementary definition of stress and strain, stress strain relationship, elastic, plastic and visco-elastic behavior of common materials in tension and compression test, stress-strain curves, Hooke's law, Poisson's ratio, elastic constants and theirrelations for an isotropic hookean material, anisotropic and orthotropic materials.

Tension, compression, shearing stress and strain, thermal stresses, composite bars, equations of static equilibrium, concept of free body diagram. Strain energy due to axial loading.

Unit II **Members Subjected to Flexural Loads:** Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beams. Bending stresses, section modulus and transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc. Strain energy due to bending.

Unit III **Principal Planes, Stresses and Strains:** Members subjected to combined axial, bending and torsional loads, maximum normal and shear stresses, concept of equivalent bending and equivalent twisting moments, Mohr's circle of stress and strain.

Theories of Elastic Failures: The necessity for a theory, different theories, significance and comparison, applications.

Unit IV **Torsion:** Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity. Strain energy due to torsional loads.

Stability of Equilibrium: Instability and elastic stability, long and short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations.

Unit V **Transverse Deflection of Beams:** Relation between deflection, bending moment, shear force and load, transverse deflection of beams and shaft under static loading, area moment method, direct integration method.

Thin-walled Pressure Vessels: Stresses in cylindrical and spherical vessels

Suggested Text / Reference Books:

1. Mechanics of Materials, James M. Gere, Cengage Learning (Brooks\Cole).
2. Mechanics of Material, Pytel and Kiusalaas, Thomson (Brooks\Cole).
3. An Introduction to the Mechanics of Solids, Crandall, Dahl and Lardner, Tata McGraw Hill.
4. Mechanics of Materials, Beer, Johnston, Dewolf and Mazurek, Tata McGraw Hill.
5. Strength of Materials, Ryder G.H., Macmillan India.
6. Strength of Materials, Sadhu Singh, Khanna Publishers.
7. Mechanics of Material, Punmia, Jain and Jain, Laxmi Publications.

Course Outcomes:

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

CO1: Recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components

CO2: Calculate Shear Force and Bending Moment diagrams for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load and couple

CO3: **E**valuate the shear stress and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.

CO4: Determine Torsional shear stress in solid, hollow and stepped circular shafts

CO5: Determine beams subjected to concentrated load, uniformly distributed load, uniformly varying load and couple and also strain energy in members subjected to gradual, sudden and impact loads

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	H	H	H	M	-	-	-	-	L	-	L	H	M
CO2	L5	H	H	H	H	M	-	-	-	-	M	-	M	M	H
CO3	L4	H	H	H	H	M	-	-	-	-	M	-	M	M	M
CO4	L5	H	H	H	H	M	-	-	-	-	M	-	H	H	M
CO5	L5	H	M	H	M	H	-	-	-	-	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEHSMC307: Fundamentals of Indian Knowledge System

Course Objective:

- Creating awareness amongst the youths about the true history and rich culture of the country;
- Understanding the scientific value of the traditional knowledge of Bharata
- Promoting the youths to do research in the various fields of Bharatiya knowledge system;
- Converting the Bharatiya wisdom into the applied aspect of the modern scientific paradigm.
- Approaches for conservation and Management of rich Indian culture.

Course Content:

Unit-I: Introduction of Indian Knowledge System (IKS)

Definition and scope of IKS, Importance of ancient knowledge, General structure of the Vedic Literature, Gurukul System of Vedic times, Main Schools of Philosophy, the Takṣaśilā University, the Nālandā University, General Introduction of Upaniṣadic Literature, Philosophical Ideas and Ethics in Upaniṣads, Ṛta, Ṛna, Puruṣārtha, Varṇa Dharma, Brahman and Ātman, Mokṣa.

Unit-II: Indian Literature and Scholars

Philosophy and Literature (Maharishi Vyas, Manu, Kanad, Pingala, Parasar, Banabhatta, Nagarjuna and Panini) Mathematics and Astronomy (Aryabhatta, Mahaviracharya, Bodhayan, Bhashkaracharya, Varahamihira and Brahmgupta) Medicine and Yoga (Charak, Susruta, Maharishi Patanjali and Dhanwantri)

Unit III: Scientific aspects of Indian Knowledge System

History and Culture of Astronomy, Sun, Earth, Moon, and Eclipses, Earth is Spherical and Rotation of Earth, Concepts of Zero and Pi, Number System, Pythagoras Theorem, and Vedic Mathematics, Origin and development of Patanjali Yoga, Ayurveda and its Relevance, Integrated Approach to Holistic Health Care

Unit IV: Ancient Technology and Architecture

Pre-Harappan and Sindhu Valley Civilization, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology, and Bet–Dwarka.

Unit-V: Protection, preservation and management of Indian Knowledge System

Documentation and Preservation of IKS, Approaches for conservation and Management of nature and bio-resources, Approaches and strategies to protection and conservation of IKS

Text books:

1. Text book on IKS: The Knowledge system of Bhārata by Prof. Bhag Chand Chauhan, Publisher: Garuda Prakashan
2. Text book on "Introduction to Indian Knowledge system: Concepts & Applications" by Mahadevan B et al. Publisher: PHI Learning
3. History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

Reference Books:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).
4. Kapoor, Kapil, Avadesh Kr. Singh (eds.) Indian Knowledge Systems (Two Vols), IIAS, Shimla, (2005)

Course Outcomes:

The learners shall be able to:

CO1 Get awareness of Indian knowledge systems, ancient wisdom, Vedic literature, philosophical schools, historical educational institutions, and key philosophical concepts, enabling them to appreciate the rich heritage of Indian thought and its relevance in today's world.

CO2 Understand the contributions of prominent Indian scholars and their works in the different fields.

CO3 Explore the scientific aspects of Indian knowledge systems.

CO4 Understand the Ancient Technology and Architecture

CO5 Analyze the Protection, preservation and management of Indian Knowledge System

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-		-	M	-	-	-	M	-	-
CO2	L2	-	-	-	-	-	L	-	-	-	-	-	M	-	-
CO3	L3	M	-	-	-	-	L	-	-	-	-	-	M	-	-
CO4	L2	L	-	L	-	-	L	-	-	-	-	-	M	-	-
CO5	L4	-	-	L	-	L		L	-	-	-	-	M	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPCC308: Machine Drawing Practice

Course Objectives:

- To Increase ability to communicate object drawing details
- To learn to sketch and take object dimensions.
- To learn to take data and transform it into graphic drawings.
- To learn basic engineering drawing formats
- To prepare the student for future engineering positions

List of Exercise

1. Assembly drawing with sectioning and bill of materials of the following: Lathe tail stock, shaper tool head, swivel machine vice etc (1 drawing sheet of any assembly)
2. Detailed part drawings from assembly drawing indicating fits, tolerances and surface finish symbols by referring BIS codes: Check-valve, Junction Valve etc(1 drawing sheet)
3. Computer Aided Drafting: Introduction to different features of the CAD Software (AutoCAD/ProE/ Creo/Solidworks). At least one drawing problem related to
   a. 2-D Drafting.
   b. 3-D Modeling.
   c. 3-D Advanced Modeling.
   d. Assembly modeling.
   e. Feature Modification and Manipulation
   f. Detailing.
   g. Surface Modeling

Course Outcomes:

Upon completion of this course, students will be able:

CO1: Understand the conventions and the method of engineering drawing.

CO2: Interpret engineering drawings using fundamental technical mathematics.

CO3: Improve their visualization skills so that they can apply these skills in developing new products.

CO4: Improve their technical skills in understanding engineering drawings.

CO5: Comprehend the theory of projection.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	L	L	L	L	-	-	-	L	L	-	L	M	L
CO2	L4	H	L	M	L	L	-	-	-	L	L	-	M	M	M
CO3	L3	H	L	L	M	L	L	-	-	L	L	-	L	L	L
CO4	L3	H	L	M	L	L	-	-	-	L	L	-	L	M	H
CO5	L4	L	L	M	L	M	-	-	-	L	L	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	------

BTMEPCC309: Materials Testing Lab

Course Objectives:

- To review physics and chemistry in the context of materials science & engineering.
- To describe the different types of bonding in solids, and the physical ramifications of these differences.

List of Exercise

1 Study of various crystals structures through models BCC, FCC, HCP, tetrahedral and octahedral voids. Material identification of, say, 50 common items kept in a box.

2 Specimen preparation for metallographic examination /micro structural examination-cutting, grinding, polishing, etching.

3 Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)

4 Heat treatment experiments such as annealing, normalizing, quenching, casehardening and comparison of hardness before and after.

5 Study of Microstructure and hardness of steel at different rates of cooling. Microstructure examination of white cast iron.

6 To perform Tensile/Compressive/Shear/torsion test on a given material and to determine its various mechanical properties under tensile/compression/Shear/torsional loading

7 To determine Rockwell/ Vickers/Brinell hardness of a given material

8 To perform Impact test on a given material and to determine its resilience.

9 To study and perform Fatigue test on a given material and to determine fatigue strength of the material

10 To perform Bending test and to determine the Young's Modulus of Elasticity via deflection of beam.

11 Creep testing on creep testing machine

Course Outcomes:

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

CO1**:** Understand the various crystals structures through models BCC, FCC & HCP

CO2: Understand the basic properties that characterize the behavior of materials

CO3: Understand the type of loadings/environment that materials should withstand

CO4: Select appropriate type of material for specific application

CO5: Apply the different approaches to modify structure/microstructure in order to get desired properties

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	L	L	L	L	-	-	-	L	L	-	L	M	M
CO2	L2	H	L	M	L	L	-	-	-	L	L	-	M	L	M
CO3	L2	H	L	L	L	L	-	-	-	L	L	-	L	M	L
CO4	L1	H	L	M	L	L	-	-	-	L	L	-	L	L	M
CO5	L3	M	L	M	L	M	-	-	-	L	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTMEPCC310: Basic Mechanical Engineering Lab

Course Objectives:

- To determine hardness of different materials using hardness testing machines.
- To determine strength of materials using testing machine.
- To learn the precautions and steps to operate different machine.

List of Exercise

1 Exposure to a wide range of applications of mechanical engineering through a variety of activities, including hands-on assembly and disassembly of machines, such as, bicycle, sewing machine, pumps, engines, air-conditioners, machine-tools, amongst others; observational study of complex systems via cut sections, visits, videos and computer simulations; design of simple machines/systems including specifications formulation; visits to industries.

2 Note: Student will be required to submit written report indicating the learning achieved by Hands on assembly/Disassembly.

Course Outcomes:

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

CO1: Understand various pumps.

CO2: Understand various tools.

CO3: Understand different mechanical systems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	L	-	-	-	-	L	-	L	M	M
CO2	L2	H	M	M	M	-	-	-	-	-	L	-	L	M	M
CO3	L2	H	M	M	M	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,
CD2	Tutorials/Assignments	CO1,CO2, CO3,
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3,
CD5	Industrial visit	

BTMEESC311: Basic Electronics Lab

Course Objectives:

- To understand the codes and number systems
- To understand the techniques to prepare the most simplified circuit

List of Exercise

1 To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3 & 4 inputs using gates with 2, 3, & 4 inputs).

2 To verify the truth table of OR, AND, NOR, Ex-OR. Ex-NOR realized using NAND & NOR gates.

3 To realize an SOP and POS expression.

4 To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables.

5 To realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor & basic Full Adder/ Subtractor.

6 To verify the truth table of 4-to-l multiplexer and l-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and l-to-8 demultiplexer using blocks of 4-to-1multiplexer and 1-to-4 demultiplexer.

7 Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -3 I 2 seven-segment display.

8 Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table.

9 Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.

10 Perform input/output operations on parallelin/parallel out and Serialin/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer.

Course Outcomes:

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

CO1: Convert different type of codes and number systems which are used in digital transmission and computer systems.

CO2: Apply the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.

CO3: Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.

CO4: Calculate different types of digital electronic circuits with and without memory element for particular operation, within the real time of performance, efficiency, user friendly and environmental constraints.

CO5: Describe the nomenclature and technology in the area of various memory devices used and apply the memory devices in different types of digital circuits for real world application.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	M	-	-	-	-	L	-	L	L	M
CO2	L3	H	M	M	M	L	-	-	-	-	L	-	L	M	M
CO3	L4	H	L	M	L	L	-	-	-	-	L	-	L	L	M
CO4	L4	H	L	M	L	L	-	-	-	-	L	-	L	M	L
CO5	L2	H	L	M	L	L	-	-	-	-	L	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTMEPROJ 312: Industrial Training / Seminar

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To identify, formulate and present model problems.
- To find engineering solutions based on a practical approach.

Course Outcomes:

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

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Become master in one's specialized technology

CO3: Become updated with all the latest changes in technological world.

CO4: Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTMEHSMC 313: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem

Course Outcomes:

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

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester-IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEBSC401	Probability and Sampling Theory	BSC	30	70	100	3	-	-	3
BTMEHSMC402	Critical Thinking	HSMC	30	70	100	2	-	-	2
BTMEPCC403	I C Engine	PCC	30	70	100	3	-	-	3
BTMEPCC404	Fluid Mechanics & Fluid Machines	PCC	30	70	100	3	1	-	4
BTMEPCC405	Manufacturing Processes	PCC	30	70	100	3	-	-	3
BTMEPCC406	Theory Of Machines	PCC	30	70	100	3	1	-	4
BTMEVAC407	Facility planning & material handling	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC408	I C Engine Lab	LC	60	40	100	-	-	1	1
BTMEPCC409	Fluid Mechanics Lab	LC	60	40	100	-	-	1	1
BTMEPCC410	Production Practice Lab	LC	60	40	100	-	-	1	1
BTMEPCC411	Theory Of Machine Lab	LC	60	40	100	-	-	1	1
BTMEHSMC 412	Social Outreach, Discipline & Extra Curricular Activates	HSMC	100	-	100	-	-	-	1
TOTAL			**550**	**650**	**1200**	19	**2**	**4**	26

BTMEBSC401: Probability and Sampling Theory

Course Objective:

- To learn basics of probability in connection with discrete and continuous instances along with real world phenomenon of standard distributions.
- To understand and apply two dimensional random variables.
- To understand and apply the sampling theory.

Course Content:

Unit I: **Probability and Random Variables:** Introduction to probability, Axioms of probability - Conditional probability - Total probability – Baye's theorem Random variable - Probability mass function - Probability density function - Properties – Moments - Moment generating functions and their properties.

Unit-II: **Standard Distributions:** Binomial, Poisson, Geometric, Uniform, Exponential, Weibull and Normal distributions and their properties.

Unit-III: **Two Dimensional Random Variables:** Joint distributions - Marginal and conditional distributions – Covariance – Correlation and regression - Transformation of random variables - Central limit theorem

Unit-IV: **Sampling theory**: Parameter, statistic, parameter estimation, hypothesis testing Sampling distributions of the means, Sampling distributions of the differences of the means, Sampling distributions of the proportions.

Unit-V: **Sampling theory**: Introduction, Test of significance, t- test, Chi square test: for goodness of fit and independence of attributes and F- test.

Text Books:

1. Ross, S., "A first course in probability", 9th Edition, Pearson Education, Delhi, 2019.
2. Medhi J., "Stochastic Processes", New Age Publishers, New Delhi, 2017. (Chapters 2, 3,4)
3. T. Veerarajan, "Probability, Statistics and Random process", Second Edition, Tata McGraw Hill, New Delhi, 2017.

Reference Books:

1. Allen A.O., "Probability, Statistics and Queuing Theory", Academic press, New Delhi, 2010.
2. Taha H. A., "Operations Research-An Introduction", Seventh Edition, Pearson Education Edition Asia, Delhi, 2014.
3. John F. Shortle , James M. Thompson, Donald Gross, Carl M. Harris Fundamentals of Queuing Theory; Wiley Series 2018.
4. Meyer P.L. "*Introduction to probability and statistical applications*", 2nd edn., American Publishing Co.
5. Hogg and craig , *Introduction to mathematical statistics*, 6th Edn,2012, Pearson education, New Delhi.
6. Ross Sheldon M, "*Introduction to Probability and Statistics for Engineers and Scientists*", Elseveir, 2010.
7. William J. Stewart, *Probability, Markov Chains, Queues and Simulation*.
8. S. Narayanan, T. K. Manicavachagom Pillay, G. Ramanaiah, *Advanced mathematics for engineering students*, S. Viswanathan Pvt.. Ltd., 1985.

Course Outcomes:

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

CO1: Explain the basic perceptions of probability of an event and associated random variables.

CO2: Compare and contrast various standard distributions with suitable statistical analysis. Apply and

CO3: Solve two dimensional random variable problems through joint distributions and central limit theorem.

CO4: Use the sampling theory to determine the significance of the differences.

CO5: Apply the test of Chi square, t test and F-test.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTMEHSMC402: Critical Thinking

Course Objective:

- This course provides practical skills with some theoretical background in the reasoning processes by which we reach conclusions in everyday life, as well as in academic disciplines. It prepares the student for critical thinking and develops his/her critical awareness, needed when faced with texts, case studies, articles, arguments, speeches, and information from the media.

Course Contents:

Unit I: **Fundamentals of Critical Thinking:** the difference between literal meaning and implication, the principles of definition, how to identify when a disagreement is merely verbal, the distinction between necessary and sufficient conditions, and problems with the imprecision of ordinary language.

Unit II: What is an Argument (Examples drawn from everyday life, philosophical, moral and legal contexts.), Rhetoric: Persuasion vs. logical support, Recognizing Arguments. Deductive Arguments: General Introduction, Validity, Soundness. Valid Argument Forms, Reductio Ad Absurdum., Fallacies related to deductive arguments. Inductive Arguments: General Introduction, Strength, Cogency, Inductive Generalizations(Enumerative Induction)

Unit III: **Argument Reconstruction:** Argument Assessment: Extraneous material; Defusing the rhetoric; logical streamlining; implicit and explicit; connecting premises; relevance; ambiguity and vagueness. Practical Reasoning: Casual generalizations. Rationally persuasive arguments; some strategies for logical assessment; refutation by counter example.

Unit IV: Fallacies Identification of major logical fallacies (false authority, circular reasoning etc.), The difference between facts and inferences, The difference between the denotative and connotative meanings of words, The differences between conscious, unconscious, warranted and unwarranted assumptions.

Unit V: Moral, Legal and Aesthetic Reasoning Principles of Moral Reasoning; Major perspectives in Moral Reasoning. Legal Reasoning. Justifying Laws, Four Perspectives. Aesthetic Reasoning. Eight aesthetic principles; Using Aesthetic Principles to Judge Aesthetic Value; Evaluating Aesthetic Criticism: Relevance and Truth; Why Reason Aesthetically.

Reference Books:

1. Bowell, T. and Kemp, G. “Critical Thinking: A Concise Guide.” Oxon: Routledge, 3rd edition, 2009.
2. Gardner, Peter S. “New Directions: Reading Writing and Critical Thinking.” Cambridge Academic Writing Collection, 2005.
3. Mayfield, Marlys. “Thinking for Yourself: Developing Critical Thinking Skills through Reading and Writing.” Eighth Edition. Boston: Wadsworth. Cengage Learning, 2010.
4. Audi, R. “Practical Reasoning and Ethical Decision.” London: Routledge, 2006.

Course Outcomes:

The learners shall be able to:

CO1: To enable students / learners to understand the logical connections between ideas.
CO2: To help them to identify, construct and evaluate arguments
CO3: To equip them to detect inconsistencies and common mistakes in reasoning
CO4: To enable them to write analytically for academic purpose
CO5: To distinguish between inferences of different types in various forms of communication.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L2	-	M	M	M	-	-	-	-	-	-	-	-	-	-
CO2	L3	-	M	M	M	-	-	-	-	-	M	-	-	-	-
CO3	L3	-	M	M	M	-	-	-	-	-	M	-	-	-	-
CO4	L2	-	M	M	H	-	-	-	-	-		-	-	-	-
CO5	L2	-	M	M	M	-	-	-	-	-	M	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTMEPCC403: Internal Combustion Engine

Course Objectives:

- To familiarize with the terminology associated with IC engines.
- To understand the basics of IC engines.
- To understand combustion, and various parameters and variables affecting it in various types of IC engines.
- To learn various systems used in IC engines and the type of IC engine required for various applications

Course Contents:

Unit-I **Introduction:** Objective, scope and outcome of the course.

History of IC engines: Nomenclature, Classification & Comparison, SI & CI, 4stroke- 2 stroke, First Law analysis, Energy Balance. Fuel air cycles, Actual cycles.

Testing & Performance: Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.

Unit-II **Fuel & Combustion:** Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines, Detonation & knocking, Theories of detonation, Control of abnormal combustion, Combustion chamber design principles, Types of combustion chamber.

Unit-III **Alternative Fuels:** Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine, Vegetable oils, Bio gas.

Engine Systems & Components: Fuel System (SI Engine), Carburetion & Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating conditions, Carburetors, types, Aircraft carburetor, comparison of carburetion & injection, F/A ratio calculations.

Unit-IV **CI engine:** Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, and pumps injectors.

Ignition system: Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark advance, centrifugal, vacuum Firing order, spark plugs.

Unit-V **Engine Friction & Lubrication:** Determination of friction, Lubrication principles, Types of lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Engine Cooling: Requirements of cooling, Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components.

Suggested Text / Reference Books:

1. Fundamentals of Internal Combustion Engines, Gupta H.N., Prentice Hall of India.
2. Internal Combustion Engines, Mathur and Sharma, Dhanpat Rai publications.
3. Internal Combustion Engines, F.Edward Obert, Harper and Raw Publisher.
4. Internal Combustion Engines Fundamentals, John B. Heyword, McGraw Hill.
5. Internal Combustion Engines, Lichty, McGraw Hill.

Course Outcomes:

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

CO1: Understand various types of I.C. Engines and Cycles of operation.

CO2: Analyze the effect of various fuel operating variables on engine performance

CO3: Identify alternative fuels

CO4: Understand normal and abnormal combustion phenomena in SI and CI engines

CO5: Evaluate performance Analysis of IC Engine and justify the suitability of IC Engine for Different application

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	M	-	-	-	-	L	-	L	M	L
CO2	L4	H	M	H	M	M	-	-	-	-	L	-	L	M	M
CO3	L2	H	H	H	H	M	-	-	-	-	L	-	L	L	M
CO4	L2	H	H	H	H	M	-	-	-	-	L	-	L	H	M
CO5	L5	H	M	H	M	M	-	-	-	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEPCC404: Fluid Mechanics & Fluid Machines

Course Objectives:

- To learn about the application of mass and momentum conservation laws for fluid flows
- To understand the importance of dimensional analysis
- To obtain the velocity and pressure variations in various types of simple flows
- To analyze the flow in water pumps and turbines.

Course Contents:

Unit I **Introduction:** Objective, scope and outcome of the course. Fluid Properties: Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Fluid Statics and Flow Characteristics: Basic equation of fluid statics, Manometers, Force on plane areas and curved surfaces, center of pressure, Buoyant force, Stability of floating and submerged bodies. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

Unit II **Flow Through Circular Conduits:** Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor-Moody diagram-minor losses – Flow through pipes in series and parallel.

Unit III **Dimensional Analysis:** Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude – Dimensionless parameters-application of dimensionless parameters – Model analysis.

Unit IV **Pumps:** Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps – classification.

Unit V **Turbines:** Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

Reference/Suggested Books:

1. Fluid Mechanics, Frank M. White, McGraw-Hill Publications.
2. Fluid Mechanics, Cengel and Cimbala, Tata McGraw-Hill, New Delhi.
3. Hydraulics and Fluid Mechanics, Modi and Seth, Standard Book House.
4. Fluid Mechanics, Jain A.K., Khanna Publishers.
5. Introduction to Fluid Mechanics, Fox and McDonald, John Wiley and Sons.

Course Outcomes:

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

CO1: Mathematically analyze simple flow situations

CO2: Design simple pipe systems to deliver fluids under specified conditions

CO3: Use conservation laws in integral form and apply them to determine forces and moments on surfaces of various shapes and simple machines

CO4: Use Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and in viscid fluids

CO5: Evaluate the performance of pumps and turbines.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	M	H	M	H	-	-	-	-	L	-	L	M	M
CO2	L5	H	M	H	M	M	L	L	-	-	L	-	L	M	L
CO3	L3	H	H	H	H	M	L	L	-	-	L	-	L	M	M
CO4	L3	H	H	H	H	H	L	L	-	-	L	-	L	H	M
CO5	L6	M	H	H	M	H	L	L	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4, CO5

BTMEPCC405: Manufacturing Processes

Course Objectives:

- To motivate and challenge students to understand and develop processes in correlation with material properties.
- To understand change in the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.
- To understand the importance of prototyping concept in manufacturing processes

Course Contents:

Unit I **Introduction:** Objective, scope and outcome of the course. General Classification and Introduction to Manufacturing processes. Foundry Technology: Casting: Definition and major classification; Casting materials, Patterns: types, material and pattern allowances. Moulding sands; composition, preparation, properties and testing; Grain fineness; moisture content, clay content and permeability test. Core & core prints; Gating system: types, pouring basin, sprue, runner and risers; Melting, pouring and solidification. Principles and method of floor mould casting, shell mould casting, pit mould and loam mould casting; centrifugal casting, investment casting; Permanent mould casting. Die casting; Slush casting. Casting defects; types, causes and remedy

Unit II **Forming Processes:** Classification; Hot working and cold working; principle, advantages, disadvantages and applications. Forging: Classification, drop forging and press forging methods and use; Forging dies; types, materials. Rolling: Characteristics and applications of hot rolling and cold rolling;

Unit III **Extrusion**: Work materials and products; Press tool works; Basic principles, system, perations and applications. Shearing; Parting, notching, trimming, nibbling, blanking and piercing, Drawing: wire drawing, tube drawing and deep drawing.

Unit IV **Metal Joining Processes:** Welding, Brazing and soldering, classification of welding process, Principle, characteristics and applications of gas welding, thermit welding, electrical arc welding; Submerged arc welding; TIG and MIG welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding. Principles and process details of Forge welding; Friction welding; Diffusion welding; Ultrasonic welding. Explosive welding. Welding defects; Types, causes, effects and remedy. Electrodes and Electrode Coatings

Unit V **Powder Metallurgy:** Properties of Powder processed materials, Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of Powder metallurgy.

Reference/Suggested Books:

1. Manufacturing Technology, Rao P.N., Tata McGraw-Hill, New Delhi.
2. Manufacturing Engineering and Technology, Kalpkajin, Addison Wesley Publishing Company.
3. Processes and Materials of Manufacture, Lindberg R. A., Prentice Hall of India.
4. Principles of Manufacturing Materials and Processes, Campbell J.S., McGraw Hill

Course Outcomes:

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

CO1- Select appropriate Manufacturing Processes to produce components.

CO2- Differentiate various metal forming processes such as Hot and Cold Working, Rolling, Forging,.

CO3- Differentiate various metal forming processes such as, Extrusion and Drawing Processes.

CO4- Use different Metal Joining Processes.

CO5- Select appropriate machine and tools for powder metallurgy.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	M	H	M	H	-	-	-	-	L	-	L	M	L
CO2	L4	H	M	H	M	M	-	-	-	-	L	-	M	M	M
CO3	L4	H	M	H	M	M	-	-	-	-	L	-	L	H	L
CO4	L3	M	H	H	M	H	-	-	-	-	L	-	-	M	M
CO5	L1	M	H	H	M	H	-	-	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPCC406: Theory of Machines

Course Objectives:

- To understand the kinematics and rigid- body dynamics of kinematically driven machine components
- To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link
- To design some linkage mechanisms and cam systems to generate specified output motion
- To understand the kinematics of gear trains

Course Contents:

Unit I **Introduction:** Objective, scope and outcome of the course. Introduction to mechanism: Basic concept of machines, links, kinematic pair, kinematic chain and mechanism. Inversions of kinematic chains: four bar chain mechanisms, quick return mechanisms, inversions of double slider crank mechanisms. Velocity and acceleration in mechanism: Velocity and acceleration polygons, relative velocity and instantaneous centre method

Unit II **Friction devices:** Types and laws of friction. Pivots and collars. Power screws such as lead screw of the lathe. Clutches: Single and multi-plate clutches. Brakes: Band, block and band and block brakes.

Unit III **Gears:** Laws of gearing, gears terminology; tooth form; interference, undercutting and minimum number of teeth on pinion. Rack and pinion, Spur, helical, basic introduction of bevel, worm and worm gears. Gear Trains: Simple, compound and epicyclic gear trains.

Unit IV **Cams:** Type of cams; displacement, velocity and acceleration curves for different cam followers; consideration of pressure angle and wear. Gyroscope: Principles of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicles taking a turn, stabilization of ship.

Unit V **Balancing:** Balancing of rotating masses in same and different planes, balancing of reciprocating masses, swaying couple, hammer blow and tractive effort.

Reference/Suggested Books:

1. Theory of Machines, Rattan S.S., Tata McGraw Hill.
2. Theory of Machines, Thomas Bevan, Pearson Education.
3. Theory of Machines and Mechanisms, Uicker, Pennocle and Shigley, Oxford University Press.
4. Mechanism and Machine Theory, Ambekar A. G., Prentice-hall Of India.
5. Theory of Mechanisms and Machines, Sharma and Purohit, Prentice-hall Of India.
6. Theory of Mechanisms and Machines, Ghosh A., Affiliated East West Press.

Course Outcomes:

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

CO1: Design various types of linkage mechanisms for obtaining specific motion and analyze them for optimal functioning

CO2: Analyze the planar mechanisms for pivots and collars.

CO3. Evaluate gear tooth geometry and select appropriate gears for the required applications.

CO4. Understand Cams and followers for specified motion profiles

CO5. Understand balancing for specified motion profiles.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L6	H	M	H	M	M	L	-	-	-	L	-	L	H	M
CO2	L4	H	M	H	H	M	-	-	-	-	L	-	L	H	M
CO3	L3	H	L	H	L	M	-	-	-	-	L	-	L	H	M
CO4	L5	H	M	H	M	M	L	-	-	-	L	-	L	M	H
CO5	L2	H	M	H	M	M	-	-	-	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTMEVAC407: Facility Planning & Material Handling

Course Objectives:

- To understand the overall facilities planning process
- To educate product, process and schedule design and their effects on the facility layout
- To introduce concepts of material handling and safety in industries

Course Contents:

Unit I Design of layout of factories, Office, Storage area etc. on consideration of facilities of working people, Storage facilities and general equipment for amenities of working people – Product, Process and combination layout – Systematic layout planning, Design of Assembly lines, Line balancing methods

Unit II Computer applications in layout designs, Environmental aspects like lighting, Ventilation, dust control, humidity. Different type of Plant services like steam compressed air etc

Unit III Plant safety, Elements off Industrial safety- Causes and prevention of accidents – Pollution and environmental consideration

Unit IV Introduction of Material Handling systems, Material Handling principles, Classification of Material Handling Equipment, Relationship of material handling to plant layout.

Unit V Methods to minimize cost of material handling- Maintenance of Material Handling Equipments, Safety in handling, Ergonomics of Material Handling equipment. Design, Miscellaneous equipment

Reference/Suggested Books:

1. A W Peymberton, Plant layout and Material Handling, John Wiley
2. James A Apple, Plant layout and Material Handlin, Krieger Pub Co,1998
3. John A Sehbin, Plant layout and Material Handling
4. K C Arora & Shinde, Aspects of Material handling, Lakshmi Publications.
5. P B Mahapatra, Operations Management, PHI, 2010

Course Outcomes:

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

CO1: Assess the value of facility planning on the strategy of a firm

CO2: Develop a systematic plant layout

CO3. Know the environmental and economical aspects in facilities planning

CO4. Understand various material handling systems

CO5. Understand minimization of cost involved in material handling.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L6	H	H	H	H	M	L	-	-	-	L	-	L	H	M
CO2	L4	H	H	H	H	M	-	-	-	-	L	-	L	H	M
CO3	L3	H	H	H	H	M	-	-	-	-	L	-	L	H	M
CO4	L5	H	M	H	M	M	L	-	-	-	L	-	L	M	H
CO5	L2	H	M	H	M	M	-	-	-	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTMEPCC408: I.C. Engines Lab

Course Objectives:

- To understand the importance of power generation in automobiles
- To get the knowledge of various strokes in I C engines

1. Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut section models.
2. Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models.
3. Study of fuel supply system of a petrol engine (fuel pump and simple carburetor)
4. Study of fuel supply system of a Diesel engine (fuel pump and fuel injector)
5. Study of Ignition systems of an IC Engine (Battery and Magneto ignition system) and Electronic ignition system.
6. Study of cooling systems of an IC Engine (air cooling and water cooling)
7. To conduct a performance test on diesel engine to draw heat balance sheet for given load and speed
8. To determine friction power of diesel engine by Willan's line or fuel rate extrapolation method.
9. To calculate the indicated power, friction power and mechanical efficiency of four stroke four cylinder petrol engine at full load and rated speed by Morse test.
10. To draw the valve timing diagram of a Four stroke S.I. or C.I. Engine using experimental setup.
11. Analysis of engine exhaust gases using Orsat apparatus / gas analyzer.

Course Outcomes:

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

CO1: Demonstrate the ability working of four stroke petrol engine and four stroke diesel engine

CO2: Examine working of two stroke petrol and two stroke diesel engine

CO3: Determine friction power of diesel engine

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	L	-	-	-	-	M	-	L	M	M
CO2	L4	H	M	M	M	M	-	-	-	-	M	-	L	M	M
CO3	L3	H	M	M	M	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3
CD5	Industrial visit	----

BTMEPCC409: Fluid Mechanics Lab

Course Objectives:

- To understand basic units of fluid measurement, convert units, and their applications
- To discuss the differences among measurement techniques, their relevance and applications

List of Exercise

1 Determination of Meta-centric height of a given body.
2 Determination of Cd, Cv & Cc for given orifice.
3 Calibration of contracted Rectangular Notch and / Triangular Notch and determination of flow rate.
4 Determination of velocity of water by Pitot tube.
5 Verification of Bernoulli's theorem.
6 Calibration and flow rate determination using Venturimeter & Orifice meter and Nozzle meter
7 Determination of head loss in given length of pipe.
8 Determination of the Reynold's number for laminar, turbulent and transient flow in pipe.
9 Determination of Coefficient for minor losses in pipes.
10 To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
11 To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
12 Conducting experiments and drawing the characteristic curves of centrifugal pump/submergible pump.
13 Conducting experiments and drawing the characteristic curves of reciprocating pump.
14 Conducting experiments and drawing the characteristic curves of Pelton wheel.
15 Conducting experiments and drawing the characteristics curves of Francis turbine.
16 Conducting experiments and drawing the characteristic curves of Kaplan turbine.

Course Outcomes:

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

CO1: Identify, name and characterize flow patterns and regimes

CO2: Understand basic units of measurement and conversion of units

CO3: Utilize basic measurement techniques of fluid mechanics

CO4: Discuss the differences among measurement techniques, their relevance and applications

CO5: Measure fluid pressure and relate it to flow velocity

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	M	M	M	-	-	-	-	L	-	L	M	M
CO2	L2	H	M	M	H	L	-	-	-	-	L	-	L	L	L
CO3	L3	H	L	L	L	L	-	-	-	-	L	-	L	M	M
CO4	L2	M	L	M	L	L	-	-	-	-	L	-	L	L	L
CO5	L3	M	L	M	L	L	-	-	-	-	L	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTMEPCC410: Production Practice Lab

Course Objectives:

- To acquaint the various conventional manufacturing shop
- To know about the applications of advanced manufacturing processes
- To learn different machine tool in details

List of Exercise

Turning Shop

1 To study lathe machine construction and various parts including attachments, lathe tools cutting speed, feed and depth of cut.
2 To perform step turning, knurling and chamfering on lathe machine as per drawing.
3 To cut multi-start Square/Metric threads on lathe machine.
4 Boring using a boring bar in a centre lathe and cut BSW/Metric internal threads on lathe machine.
5 To perform taper turning using compound rest.

Machine shop

1 To study the milling machine, milling cutters, indexing heads and indexing methods and to prepare a gear on milling machine.
2 To machine a hexagonal /octagonal nut using indexing head on milling machine.
3 To study of single point cutting tool geometry and to grind the tool as per given tool geometry.
4 To study shaper machine, its mechanism and calculate quick return ratio. To prepare a job on shaper from given mild steel rod.
5 Cylindrical grinding using grinding attachment in a centre lathe

Demonstration and study

1 Demonstration for job by eccentric turning on lathe machine.
2 Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
3 Demonstration on milling machine for generation of plane surfaces and use of end milling cutters.
4 Grinding of milling cutters and drills.

Foundry Shop

1 To prepare mould of a given pattern requiring core and to cast it in aluminum.
2 To perform moisture test and clay content test.
3 To perform permeability test
4 A.F.S. Sieve analysis test.
5 Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).

Welding Shop

1 Hands-on practice on spot welding

Course Outcomes:

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

CO1: **Get** knowledge in various metal cutting operations in machine tools like lathe, drilling, milling, grinding, shaping, and planning

CO2: Know various machine tools and equipment for manufacturing

CO3: Make various types of threads

CO4: Understand the concept of patterns.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	L	L	L	H	-	-	-	L	L	-	L	M	M
CO2	L1	H	L	L	L	H	-	-	-	L	L	-	M	M	L
CO3	L3	M	L	M	L	H	-	-	-	L	L	-	M	M	M
CO4	L2	H	L	M	M	L	-	-	-	L	L	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	----

BTMEPCC410: Theory of Machine Lab

Course Objectives:

- To determine the balancing of masses of rotating and reciprocating machine elements.
- To understand the principles of gyroscope and governors
- To understand working of brakes and dynamometer
- To determine the moment of inertia of various mechanical systems.

List of Exercise

1 To study inversions of four bar chain and slider crank mechanism and their practical applications.
2 To study Steering Mechanisms: Davis and Ackerman.
3 Study of quick return mechanism and its practical applications.
4 Study of inversion of Double slider chain: Oldham Coupling, Scotch Yoke and Elliptical Trammel.
5 Study of various cam-follower arrangements. To plot displacement v/s angle of rotation curve for various cams
6 To determine co-efficient of friction using two roller oscillating arrangement.
7 Study of various types of dynamometers, Brakes and Clutches.
8 Study of differential gear box.
9 To verify the torque relation for gyroscope.
10 To perform wheel balancing. To perform static and dynamic balancing on balancing set up.
11 Study of a lathe gear box, sliding mesh automobile gear box, planetary gear box.

Course Outcomes:

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

CO1: Apply the principles of balancing of masses to various links, mechanisms and engines.

CO2. Apply the principles of gyroscopic effects and stabilization on various transport vehicles and applications of various governors.

CO3. Understand the working principles of brakes and dynamometer.

CO4. Determine moment of inertia of mechanical systems.

CO5. Determine the vibration parameters of different systems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	L	M	L	M	L	-	-	L	L	-	L	L	M
CO2	L3	H	L	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L2	H	L	M	L	M	L	-	-	-	L	-	L	L	M
CO4	L5	H	L	M	L	M	-	-	-	L	L	-	L	M	H
CO5	L5	H	L	M	L	M	L	-	-	L	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----

BTMESODECA 411: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- Allowing students to explore strengths and talents outside of academics.
- Helping students develop stronger time-management and organizational skills.

Course Outcomes:

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

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester-V

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC501	Mechatronics Systems	PCC	30	70	100	3	-	-	3
BTMEPCC502	Heat Transfer	PCC	30	70	100	3	-	-	3
BTMEPCC503	Manufacturing Technology	PCC	30	70	100	3	-	-	3
BTMEPCC504	Design Of Machine Elements I	PCC	30	70	100	3	-	-	3
BTMEPCC505	Manufacturing Automation	PCC	30	70	100	3	-	-	3
BTMEHSMC506.A	Industrial Psychology	HSMC (**Elective I)**	30	70	100	3	-	-	3
BTMEHSMC506.B	Operations Research								
BTHSMC 507	Professional Skills	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC508	Mechatronics Lab	LC	60	40	100	-	-	1	1
BTMEPCC509	Heat Transfer Lab	LC	60	40	100	-	-	1	1
BTMEPCC510	Production Engineering Lab	LC	60	40	100	-	-	1	1
BTMEPCC511	Machine Design Practice Lab	LC	60	40	100	-	-	1	1
BTMEPROJ512	Industrial Training/ Seminar	PRJ	60	40	100	-	-	1	1
BTMEHSMC 513	Social Outreach, Discipline & Extra Curricular Activates	HSMC	100	-	100	-	-	-	1
TOTAL			**610**	**690**	**1300**	**20**	**0**	**5**	**26**

BTMEESC501: Mechatronics Systems

Course Objectives:

- To understand the structure of microprocessors and their applications in mechanical device
- To understand the principle of automatic control and real time motion control systems, with the help of electrical drives and actuators
- To understand the use of micro-sensors and their applications in various fields

Course Contents:

Unit I. **Introduction:** Objective, scope and outcome of the course. Overview of Mechatronics: Historical perspective, Definition, Applications, Block diagram of Mechatronic system, Functions of Mechatronics Systems, Systems Engineering, Verification Vs Validation, Benefits of mechatronics in manufacturing. Electrical and Electronic Systems: Electrical circuits and Kirchhoff's laws, Network Theorems and AC circuit Analysis, Transformers, Analog Devices, Signal Conditioning, Digital Electronics, Data Acquisition systems.

Unit II. M**odeling, Analysis and Control of Physical Systems:** Basics of System Modeling: LTI and LTV systems, Need for modeling, Types of modeling, Steps in modeling, Building blocks of models, Modelling of one and two degrees of freedom systems, Modeling of Electromechanical systems, Mechanical Systems, Fluid systems, Thermal systems; Dynamic Responses, System Transfer Functions, State Space Analysis and System Properties, Stability Analysis using Root Locus Method, , PID Controllers (with and without Time Delay)

Unit III. **Sensors and Actuators:** Static characteristics of sensors and actuators, Position, Displacement and Proximity Sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors, Actuators: Electrical Actuators (Solenoids, Relays, Diodes, Thyristors, Triacs, BJT, FET, DC motor, Servo motor, BLDC motor, AC motor, Stepper motors), Hydraulic and Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

Unit IV. **Microprocessors, Microcontrollers and Programmable Logic Controllers:** Logic Concepts and Design, System Interfaces, Communication and Computer Networks, Fault Analysis in Mechatronic Systems, Synchronous and Asynchronous Sequential Systems, Architecture, Microcontrollers.

Unit V. **Programmable Logic Controllers (PLCs):** Architecture, Number Systems Basics of PLC Programming, Logics, Timers and Counters, Application on real time industrial automation systems. Case Studies: Design of pick and place robot, Car engine management system, Automated manufacturing system, Automatic camera, Automatic parking system, Safety devices and systems.

Suggested Text / Reference Books:

1. D. Shetty & R. Kolk, Mechatronics System Design, PWS Publishers
2. Mechatronics – HMT, Tata McGraw Hill Publishing Company Ltd.
3. Aditya P. Mathur, Introduction to Microprocessors, Tata McGraw Hill.

4. C. R. Venkataramana, Mechatronics, Sapna Book house, Bangalore.

Course Outcomes:

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

CO1: Identify the key elements of Mechatronics system, representation into block diagram

CO2: Apply knowledge of the concept of signal processing and signal conditioning for its industrial applications

CO3: Analyze the requirements for a given industrial process and select the most appropriate Actuators, sensors, design circuit according to applications

CO4: Understand the different logic gates, architecture of microprocessor and microcontroller for industrial applications.

CO5: Develop mechatronics system according to an Industrial Applications

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	M	M	M	H	-	-	-	-	M	-	L	M	M
CO2	L3	M	M	L	M	M	-	-	-	-	M	-	L	H	M
CO3	L4	H	H	L	H	M	-	-	-	-	H	-	L	M	L
CO4	L2	H	L	H	L	M	-	-	-	-	L	-	L	L	M
CO5	L6	M	M	M	M	H	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3

BTMEPCC502 : Heat Transfer

Course Objectives:

- To build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
- To study rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.

Course Contents:

Unit I. **Introduction:** Objective, scope and outcome of the course. Introduction: Heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling, definition of overall heat transfer coefficient. General parameters influence the value of heat transfer coefficient. Conduction: General 3-Dimensoinal conduction equation in Cartesian, cylindrical and spherical coordinates; different kinds of boundary conditions; nature of differential equations; one dimensional heat conduction with and without heat generation; electrical analogy; heat conduction through composite walls; critical thickness of insulation.

Unit II. **Heat transfer from extended surfaces:** Governing differential equation of fin, fin efficiency and effectiveness for different boundary conditions. Unsteady state heat conduction for slab, cylinder and sphere, Heisler chart. Convection: Review of Navier – Stokes and energy equation, hydrodynamic and thermal boundary layers; laminar boundary layer equations; forced convection appropriate non dimensional members; effect of Prandtl number; empirical relations for flow over a flat plate and flow through pipes.

Unit III. **Natural convection:** Dimensional analysis, Grashoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations. Heat transfer with change of phase: Nature of vaporization phenomena; different regimes of boiling heat transfer; correlations for saturated liquid vaporization; condensation on flat plates; correlation of experimental results, drop wise condensation.

Unit IV. **Heat exchanger:** Types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method, fouling factor. Constructional and manufacturing aspects of Heat Exchangers.

Unit V. **Thermal Radiation:** Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces.

Suggested Text / Reference Books:

1. Heat Transfer, Holman J.P., Tata McGraw-Hill, New Delhi.
2. Heat and Mass Transfer, Cengel, Tata McGraw-Hill, New Delhi.
3. Heat and Mass Transfer, Kumar D.S., Kataria and Sons.
4. Heat Transfer, Sharma and Lal, Vardhan Publisher Jaipur.
5. Heat and Mass Transfer, Nag P.K., Tata McGraw-Hill, New Delhi.
6. Fundamental of Heat and Mass Transfer, Thirumaleshwar M., Pearson Education.
7. Heat Transfer, Rajput R.K., S. Chand Publication.

Course Outcomes:

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

CO1. Formulate and analyze a heat transfer problem involving any of the three modes of heat transfer

CO2. Obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer

CO3. Determine performance of thermal systems related to one dimension, steady state natural and Forced Convection heat transfer by theoretically and experimentally.

CO4. Design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.

CO5. Determine performance of thermal systems related to thermal radiation.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4,L6	H	M	H	M	L	-	L	-	L	M	-	L	M	L
CO2	L4	H	M	H	M	L	-	L	-	-	M	-	L	M	M
CO3	L6	H	M	H	M	L	-	-	-	-	M	-	L	L	M
CO4	L3	H	H	H	H	L	-	L	-	-	H	-	L	M	L
CO5	L5	H	M	H	M	L	-	-	-	-	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPCC503: Manufacturing Technology

Course Objectives:

- To provide knowledge on machines and related tools for manufacturing various components.
- To understand the relationship between process and system in manufacturing domain.
- To identify the techniques for the quality assurance of the products and the optimality of the process in terms of resources and time management.

Course Contents:

Unit I. **Introduction:** Objective, scope and outcome of the course. Classification of metal removal process and machines: Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS. Concept of orthogonal and oblique cutting. Type of chips, Mechanics of metal cutting; interrelationships between cutting force, shear angle, strain and strain rate. Thermal aspects of machining and measurement of chip tool interface temperature.

Unit II. Concept of machinability, machinability index, factors affecting machinability, Different mechanism of tool wear. Types of tool wear (crater, flank etc), Concept of tool life. Taylor's tool life equation. Introduction to economics of machining. Cutting fluids: Types, properties, selection and application methods

Unit III. **Basic machine tools:** Constructional configuration, estimation of machining time on lathe, drilling, shaping, milling, grinding, Gear cutting on milling, Gear hobbling. Special Purpose Machine Tools: Automatic lathes, capstan and turret lathe machines, operational planning and turret tool layout, sequence of operations.

Unit IV. Introduction to Grinding and different methods of grinding, Abrasives; natural and synthetic, manufacturing and selection of grinding wheels, Wheel specifications. Honing, lapping, super finishing.

Unit V. High Velocity Forming Methods: Definition; Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming.

Suggested Text / Reference Books:

1. Manufacturing Science, Ghosh and Mallik, Tata McGraw-Hill
2. Manufacturing Technology II, Rao P.N., Tata McGraw-Hill
3. Production Technology, Jain R.K., Khanna Publisher.
4. Production Technology, HMT Banglore, Tata McGraw-Hill
5. Mechanical Measurement and Metrology, Jain R.K., Khanna Publisher.
6. Metal Cutting Principles, Shaw M.C., Oxford
7. Manufacturing Tool Design, Mehta N.K., Tata McGraw Hill.

Course Outcomes:

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

CO1: Learn the tooling needed for manufacturing,

CO2: Understand the dimensional accuracy.

CO3: Apply the knowledge of different machines like lathe, shaper etc.

CO4: Analyze grinding operations.

CO5: Understand application of unconventional machining methods in manufacturing.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	M	H	M	H	L	-	-	-	M	-	L	L	H
CO2	L2	H	M	H	M	M	-	-	-	-	M	-	L	M	M
CO3	L3	H	M	H	M	M	-	-	-	-	M	-	L	L	L
CO4	L4	H	M	H	M	H	-	-	-	-	M	-	L	M	H
CO5	L2	H	M	H	M	H	-	-	-	-	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEPCC504: Design of Machine Elements I

Course Objectives:

- To understand the origins, nature and applicability of empirical design principles, based on safety considerations
- To understand the codes, standards and design guidelines for different elements

Course Contents:

Unit I **Introduction:** Objective, scope and outcome of the course. Materials: Mechanical Properties and IS coding of various materials, Selection of material from properties and economic aspects.

Unit II **Manufacturing Considerations in Design:** Standardization, Interchangeability, limits, fits tolerances and surface roughness, BIS codes, Design consideration for cast, forged and machined parts. Design for assembly. Design for Strength: Modes of failure, Strength and Stiffness considerations, Allowable stresses, factor of safety, Stress concentration: causes and mitigation, fatigue failures.

Unit III **Design of Members subjected to direct stress:** pin, cotter and keyed joints. Design of Members in Bending: Beams, levers and laminated springs. Design for stiffness of beam: Use of maximum deflection formula for various end conditions for beam design

Unit IV **Design of Members in Torsion Shaft and Keys:** Design for strength, rigidity. Solid and hollow shafts. Shafts under combined loading. Sunk keys. Couplings: Design of muff coupling, flanged couplings: rigid and flexible

Unit V **Design of Threaded fasteners:** Bolt of uniform strength, Preloading of bolts: Effect of initial tension and applied loads, Eccentric loading Power screws like lead screw, screw jack Design of members which are curved like crane hook, body of clamp, machine frame etc.

Suggested Text / Reference Books:

1. Mechanical Machine Design, Bahl and Goel, Standard Publishers Distributors.
2. Design of Machine Elements, Bhandari V.B, Tata McGraw-Hill, New Delhi.
3. Machine Design, Sharma and Aggarwal, S.K.Kataria and Sons, Delhi.
4. Mechanical Engg Design, Shigley, Mischke, Budynas and Nisbett, Tata McGraw-Hill.
5. Design of Machine Elements, Sharma and Purohit, Prentice Hall India.
6. Machine Design, Kulkarni S. G., Tata McGraw Hill
7. A Text Book of Machine Design, Karwa A., Laxmi Publications.
8. Machine Design, Hall, Holwenko and Laughlin, Schaum's Outlines Series, Tata McGraw Hill.

Course Outcomes:

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

CO1: Recognize the design methodologies employed for the design of various machine components.

CO2: Apply knowledge of the stress and strain of mechanical components

CO3: Develop Logical and Analytical ability to apply Knowledge of various theories of failures for design of Mechanical components use in Industries

CO4: Understand the mechanism of torsion shaft and its use in mechanical component design.

CO5: Understand different welded and riveted joints structure and able to apply its knowledge to analyze its strength when subjected to simple, coplanar and eccentric loading.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	H	-	-	-	-	H	-	L	M	H
CO2	L3	H	M	H	M	M	-	-	-	-	M	-	L	M	M
CO3	L6	H	H	H	H	M	-	-	-	-	H	-	L	H	M
CO4	L2	H	H	H	H	M	-	-	-	-	H	-	L	M	M
CO5	L2	H	M	H	M	M	-	-	-	-	M	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEPCC505: Manufacturing Automation

Course Objectives:

- To understand the importance of automation in the of field machine tool based manufacturing
- To get the knowledge of various elements of manufacturing automation – CAD/CAM, sensors, pneumatics, hydraulics and CNC

Course Contents:

Unit I **Introduction:** Definition; Reasons for automating; Strategies; Types of automation; Numerical control (NC, CNC, DNC); Introduction to CNC programming and computer-aided process planning.

Machine and Process Automation: CNC machines, Automated flow lines (types, selection); Work part transport and transfer mechanisms; Feedback systems and control; Modular and reconfigurable machines, adaptive machine controls.

Unit II **Automated Assembly Systems:** Historical developments; Choice of assembly methods; Design for automated assembly; Transfer systems; Vibratory and non-vibratory feeders; Feed tracks, part orienting and placing mechanisms.

Unit III **Factory Automation:** Lean manufacturing, Automation scalability (fixed, programmable, flexible and reconfigurable); Design and analysis of automated flow lines; Average production time, production rate, line efficiency; Analysis of transfer lines without storage; Partial and full automation.

Unit IV **Automation Tools and Techniques:** Mechanical, electro-mechanical, pneumatic and hydraulic systems; Sensors integration; Process monitoring, data analysis and control using actuators; Robots (pick, place, assembly, welding, painting, etc.); Automatic Guided Vehicles; Automated inspection and measurement (CMM and 3D Scanning); Machine vision, AI and machine learning; Human- machine interfaces; Examples and case studies.

Unit V **Advanced Automation Trends:** Digital, inclusive, smart and distributed manufacturing; Industry 4.0; Digital transformations in shop-floors (CIM to Smart factory; Intelligent machines to Smart Machines; Factory automation to Distributed automation; Human sense to system sensed).

Suggested Text / Reference Books:

1. M. P. Groover, Automation, Production Systems and Computer-integrated Manufacturing, Prentice Hall, 2018.
2. S. Kalpakjian and S. R. Schmid, Manufacturing – Engineering and Technology, Pearson.
3. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill, 2005
4. CAD/CAM Principles and Applications, P.N. Rao, Tata McGraw Hill, 2010.

Course Outcomes:

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

CO1: To understand the importance of automation in manufacturing value chain

CO2: To get the knowledge of various elements of automation tools and techniques

CO3: To understand the emerging digital manufacturing trends

CO4: To understand human- machine interfaces

CO5: To understand factory automation to distributed automation

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	H	-	-	-	-	H	-	L	M	H
CO2	L3	H	M	H	M	M	-	-	-	-	M	-	L	M	M
CO3	L6	H	H	H	H	M	-	-	-	-	H	-	L	H	M
CO4	L2	H	H	H	H	M	-	-	-	-	H	-	L	M	M
CO5	L2	H	M	H	M	M	-	-	-	-	M	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEHSMC506.A: Industrial Psychology

Course Objectives:

- To develop an awareness of the major perspectives underlying the field of Industrial Psychology
- To understanding for the potential Industrial Psychology has for society and organizations now and in the future.

Course Contents:

Unit I: The role of the psychologist in industry, the field of occupational Psychology: Study of behavior in work situation and applications of Psychological principles to problems of selection, Placement, Counseling and training

Unit II: Design of Work Environments: Human engineering and physical environment techniques of job analysis, Social environment: Group dynamics in Industry Personal psychology, Selection, training, placement, promotion, counseling, job motivations, job satisfaction. Special study of problem of fatigue, boredom and accidents

Unit III: Understanding Consumer Behavior: Consumer behaviour, study of consumer preference, effects of advertising, Industrial morale: The nature and scope of engineering psychology, its application to industry

Unit IV: Test of Psychology Effectiveness of these tests; Measures to control the tests steps to improve the psychology

Unit V: Individual and group behavior Interaction and psychology involved in individuals; Improving psychology; Group Dynamics

Suggested Text / Reference Books:

1. Aamodt, M.G. (2007) Industrial/Organizational Psychology: An Applied Approach (5th edition) Wadsworth/Thompson: Belmont, C.A.2. Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi: Tata McGraw Hill

Course Outcomes:

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

CO1: Understand key concepts, theoretical perspectives, and trends in industrial psychology

CO2: To Evaluate the problems thorough and systematic competency model.

CO3: To understand problems present in environment and design a job analysis method.

CO4: To understand a better work environment for better performance

CO5: To understand and design a performance appraisal process and form for the human behavior.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	H	-	-	-	-	H	-	L	M	H
CO2	L3	H	M	H	M	M	-	-	-	-	M	-	L	M	M
CO3	L6	H	H	H	H	M	-	-	-	-	H	-	L	H	M
CO4	L2	H	H	H	H	M	-	-	-	-	H	-	L	M	M
CO5	L2	H	M	H	M	M	-	-	-	-	M	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEHSMC506.B: Operations Research

Course Objectives:

- To Facilitate this understanding of the concept of Operations Research
- To Help the Students to Understand the Various Techniques of Solving Problems

Course Contents:

Unit I: **Linear programming problems -** Mathematical formulation, graphical method of solution, simplex method

Unit II: Duality in linear programming problems, dual simplex method, sensitivity analysis, transportation and assignment problems, Traveling salesman Problem

Unit III: Game theory Introduction, two-person zero-sum games, some basic terms, the maxmini- minimax principle, games without saddle points-Mixed Strategies, graphic solution of 2 *n and m*2 games, dominance property. CPM & PERT

Unit IV: **Queuing theory** -basic structure of queuing systems, roles of the Poisson and exponential distributions, classification of queues basic results of M/M/1: FIFO systems, extension to multi-server queues.

Unit V: **Simulation:** simulation concepts, simulation of a queuing system using event list, pseudo random numbers, multiplication congruential algorithm, inverse transformation method, basic ideas of Monte-Carlo simulation.

Suggested Text / Reference Books:

1. Joseph.G.Ecker & Michael Kupper Schimd, Introduction to operations Research, John Wiley & Sons, 1988.
2. Hillier.F.S & Liberman.G.J, operation Research, Second Edition, Holden Day Inc, 1974.
3. Kanti Swarup, Gupta.P.K. & Man Mohan, operations Research, S.Chand & Sons

Course Outcomes:

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

CO1: Develop models for optimizing the management and production systems from the verbal description of the real system.

CO2: Make use of LPP techniques for optimization of Production mix problem in industry.

CO3: Evaluate transportation, transshipment, assignment and travelling salesman and Queuing problem.

CO4: Apply quantitative techniques in machine replacement, game theory, business decision making under conditions of certainty, risk and uncertainty.

CO5: Demonstrate Project management Problem

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	H	H	H	-	-	-	-	H	-	L	M	H
CO2	L3	M	M	H	M	M	-	-	-	-	M	-	L	M	M
CO3	L6	M	H	H	H	M	-	-	-	-	H	-	L	H	M
CO4	L2	M	H	H	H	M	-	-	-	-	H	-	L	M	M
CO5	L2	M	M	H	M	M	-	-	-	-	M	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTHSMC 507: Professional Skills

Course Objectives:

- To acquire career skills and fully pursue to partake in a successful career path.
- To prepare a good resume.
- To prepare for interviews and group discussions.
- To understand the significance of team skills.
- To acquire team skills.
- To design, develop, and adapt to situations as an individual and as a team member.

Course Content:

Unit I: Career Skills (Resume Skills and Interview Skills)

Resume Skills: Preparation and Presentation: Introduction of Resume and Related Terms, Importance of Preparing a Good Resume, Difference between a CV, Resume, and Biodata, Essential Components of a Good Resume.

Resume Skills: Common Errors: Common Errors, Guidelines for Resume Preparation.

Interview Skills: Preparation and Presentation: Meaning of Interview, Types of Interview, STAR Approach for Facing an Interview.

Interview Procedure: Do's and Don'ts, Important Questions Generally Asked in a Job Interview.

Interview Skills: Common Errors: Common Errors, Interview Questions for Assessing Strengths and Weaknesses.

Simulation: Job Simulation Formats, Comment Critically on Simulated Interviews.

Demonstrate an Ideal Interview.

Unit II: Career Skills (Group Discussion Skills and Exploring Career Opportunities)

Meaning and Importance of Group Discussion (GD): Meaning of a Group Discussion, Importance of a Group Discussion, Types of Group Discussions.

Procedure of a Group Discussion: Methodology, Ground Rules, Stages of group formations, Evaluation of Group Discussion, Group Discussion Common Errors, Simulation

Process of Career Exploration, Knowing Yourself — Personal Characteristics, Knowledge about the World of Work, Requirements of Jobs Including Self-employment. Sources of Career Information. Preparing for a Career Based on Potentials of Learners and Availability of Opportunities

Unit III: Team Skills (Cognitive and Non-cognitive Skills and Presentation Skills)

Cognitive Skills: Meaning, types of cognitive skills, and strategies. Critical Thinking Skills. Problem-solving Skills, Ability to Learn.

Non-cognitive Skills: Meaning, Types of Non-Cognitive skills and Strategies, Empathy, Teamwork, Creativity, Collaboration, Resilience, Interpersonal Skills, Perseverance, Self Control, Social Skill, Peer Pressure, Stress and Stress Management.

Presentation: Meaning and Types: Meaning of Presentation, Types of Presentations, Presentation for Internal and External Communication, Presentation Strategies, Ways to Improve Presentation Skills over Time.

Unit IV: Team Skills (Trust and Collaboration and Listening as a Team Skill)

Explain the importance of trust in creating a collaborative team: Definition of Trust, Importance of Trust in Creating a Collaborative Team. Strategies to Build Trust with Employees. Criteria for Evaluation of Trust and Collaboration in Teams. Agree to Disagree and Disagree to Agree – Spirit of Teamwork.

Understanding Fear of Being Judged and Strategies to Overcome Fear: Understanding the Fear of Being Judged, Signs and Symptoms of Social Anxiety Disorder, Strategies to Overcome Fear or Social Anxiety. Listening as a Team Skill: Listening Skill, Advantages of Effective Listening Skills, Types of Listening. Listening as a Team Member and Team Leader: Listening as a Team Leader, Listening as a Team Member, Improving Listening Skills. Uses of Active Listening Strategies to Encourage Sharing of Ideas: The Importance of Active Listening in the Workplace, Strategies for Improving Active Listening Skills to Encourage Sharing of Ideas

Unit V: Team Skills (Brainstorming, Social and Cultural Etiquettes, Internal Communication)

Brainstorming as a Technique to Promote Idea Generation: Brainstorming: The Meaning and Process, Procedure for Conducting Brainstorming, Importance of Using the Brainstorming Technique, Types of Brainstorming.

Learning and Showcasing the Principles of Documentation of Team Session Outcomes

Etiquette: Meaning, Need for Effective Interpersonal Relationships

Aspects of Social and Cultural/Corporate Etiquette in Promoting Teamwork: Social Etiquette, Cultural Etiquette and its role in promoting teamwork, Corporate/Professional Etiquette

Internal Communication: Meaning and Need: Meaning, Need for Internal Communication.

Use of Various Channels of Transmitting Information to Team Members including Digital and Physical

Reference Books:

1. Lee, K. (2021, February 14). How to Write a Neat Resume. Wikihow. https://www..com/Write-a-Neat-Resume
2. Moore, E. (2019, January 23). What Is a Job Simulation & How Can You Prepare for One?.Glassdoor. https://www.glassdoor.com/blog/job-simulation-preparation/
3. Griffin, T. (2022, September 26). How to Conduct a Group Discussion. wikiHow. https://www.wikihow.com/Conduct-a-Group-Discussion
4. McKay, D. R. (2022, September 13). The Career Planning Process. The Balance. https://www.thebalancecareers.com/the-career-planning-process-524774.
5. Kapoor, I., Sharma, S., & Khosla, M. (2020). Social Anxiety Disorder Among Adolescents in Relation to Peer Pressure and Family Environment. Bioscience Biotechnology Research Communications, 13(2), 923-929.
6. Gilda Bonanno. (n.d.). Presentation skills coaching videos. home. https://www.gildabonanno. com/presentation-skill-coaching-videos.
7. Mind Tools. (n.d.). Building Trust Inside Your Team. Mind Tools https://www.mindtools.com/pages/article/building-trust-team.htm.
8. Roy, B. D. (2022, August 1). Active listening; its skills and importance in the workplace. Nurture an Engaged and Satisfied Workforce | Vantage Circle HR Blog. https://blog.vantagecircle.com/active-listening/.
9. Wikimedia Foundation. (2022, November 16). Brainstorming. Wikipedia. https://en.wikipedia.org/wiki/Brainstorming.
10. Lyon, S. (2022, September 22). How to be socially acceptable in all situations. The Spruce.https://www.thespruce.com/what-is-etiquette-and-why-is-it-important-1216650.
11. Sinclair, S. (2021, February 8). This is why internal and external communication should work in Harmony. Employee Engagement App. https://www.talkfreely.com/blog/internal-and-external-communication.

Course Outcomes:

	The learners shall be able to:
CO1	Prepare their résumé on an appropriate template without grammatical and other errors and using proper syntax. Participate in a simulated interview.
CO2	Actively participate in group discussions towards gainful employment. Perform appropriately and effectively in group discussions. Identify career opportunities in consideration of personal potential and aspirations.
CO3	Demonstrate a set of cognitive skills such as critical thinking, problem-solving and the ability to learn for smooth and efficient functioning at a workplace. Demonstrate a set of non-cognitive skills such as empathy, creativity, teamwork, and collaboration, for smooth and efficient functioning at a workplace. Use common technology messaging tools that are used in an organization for the flow of information and transition from command and control to informal communication during an online or offline team session.
CO4	Demonstrate a set of cognitive and non-cognitive skills for maintaining good interpersonal relations and smooth and efficient functioning at a workplace. Empathize with and trust colleagues for improving interpersonal relations.
CO5	Generate, share and maximize new ideas with the concept of brainstorming and the documentation of key critical ideas/thoughts articulated and action points to be implemented with timelines in a team discussion (as MOM) in identified applicable templates. Project a good personal image and social etiquette so as to have a positive impact on building of the chosen career

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Bloom's Levels**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L6								**H**	**L**			**M**	**L**	**L**
CO2	L3									**M**	**M**		**M**	**L**	**L**
CO3	L3		**M**	**M**	**M**	**M**				**M**			**M**	**L**	**M**
CO4	L3						**M**		**L**	**M**	**M**		**M**	**L**	**M**
CO5	L3		**L**							**H**	**H**		**M**	**L**	**M**

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPCCC508 : Mechatronics Lab

Course Objectives:

- To understand the synergistic concept of mechanical and electronic systems.
- To understand and gain knowledge of different Mechatronics systems.

List of Exercise

1 Using Transducers Kit :-

- Characteristics of LVDT
- Principle & Characteristics of Strain Gauge
- Characteristics of Summing Amplifier
- Characteristics of Reflective Opto Transducer

2 Mobile Robot

- Program for Operating Buzzer Beep
- Program for Operating Motion control
- Program for Operating Direction control
- Program for Operating White line follower for the given arena

3 PLC PROGRAMMING

- Ladder programming on Logic gates ,Timers & counters
- Ladder Programming for digital & Analogy sensors
- Ladder programming for Traffic Light control, Water level control and Lift control Modules

4 MATLAB Programming

- Sample programmes on Mat lab
- Simulation and analysis of PID controller using SIMULINK

Course Outcomes:

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

CO1: Analyze the velocity and direction of fluid power circuit with the help of simulation software.

CO2: Study and demonstrate the fluid power circuits using PLC

CO3: Observe interface between stepper motor and 8051 micro controller

CO4: Simulate the basic electric, hydraulic and pneumatic system using simulation software.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	L	H	L	M	-	-	-	-	L	-	L	H	M
CO2	L3	H	M	L	M	M	-	-	-	-	L	-	L	M	M
CO3	L2	M	L	H	L	M	-	-	-	-	L	-	L	L	L
CO4	L3	H	L	M	L	L	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	-----

BTMEPCC508: Heat Transfer Lab

Course Objectives:

- To provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.
- To get knowledge of heat exchange for plane, cylindrical & spherical geometries and ability to compare the performance of extended surfaces and heat exchangers

NAME OF EXPERIMENT

1 To Determine Thermal Conductivity of Insulating Powders.
2 To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
3 To determine the transfer Rate and Temperature Distribution for a Pin Fin.
4 To Measure the Emissivity of the Test plate Surface.
5 To Determine Stefan Boltzmann Constant of Radiation Heat Transfer.
6 To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.
7 Determination of Heat Transfer Coefficient in Drop Wise and Film Wise condensation.
8 To Determine Critical Heat Flux in Saturated Pool Boiling.
9 To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
10 To Find the Heat transfer Coefficient in Forced Convection in a tube.
11 To study the rates of heat transfer for different materials and geometries
12 To understand the importance and validity of engineering assumptions through the lumped heat capacity method.

Important Note:

Course Outcomes:

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

CO1: Understand the basic laws of heat transfer.

CO2: Understand the consequence of heat transfer in thermal analyses of engineering systems.

CO3: Analyze problems involving steady state heat conduction in simple geometries.

CO4: Develop solutions for transient heat conduction in simple geometries.

CO5: Understand the fundamentals of convective heat transfer process. i.e. Natural, forced and mixed convection in various type of flow. i.e. internal and external flow.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	M	L	L	-	-	-	-	L	-	L	M	M
CO2	L5	H	L	M	L	M	-	-	-	-	L	-	L	M	M
CO3	L4	H	H	M	H	M	-	-	-	-	H	-	L	M	M
CO4	L6	H	H	M	H	L	-	-	-	-	H	-	L	L	M
CO5	L2	H	H	M	H	M	-	-	-	-	H	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4,CO5

BTMEPCC510: Production Engineering Lab

Course Objective:

- To know about tool life, MRR, Cutting forces and surface finish in different machining process
- To understand different types of strength test

NAME OF EXPERIMENT

1 Study of various measuring tools like dial gauge, micrometer, vernier caliper and telescopic gauges.
2 Measurement of angle and width of a V-groove by using bevel protector..
3 (a) To measure a gap by using slip gauges
(b) To compare & access the method of small-bore measurement with the aid of spheres.
4 Measurement of angle by using sine bar.
5 (a) Measurement of gear tooth thickness by using gear tooth vernier caliper.
(b) To check accuracy of gear profile with the help of profile projector.
6 To determine the effective diameter of external thread by using three- wire method.
7 To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat.
8 To check the accuracy of a ground, machined and lapped surface - (a) Flat surface (b) Cylindrical surface.
9 Find out Chip reduction co-efficient (reciprocal of chip thickness ratio) during single point turning.
10 Forces measurements during orthogonal turning.
11 Torque and Thrust measurement during drilling.
12 Forces measurement during plain milling operation.
13 Measurement of Chip tool Interface temperature during turning using thermocouple technique.

Course Outcomes:

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

CO1: Define metal cutting operations in machine tools like lathe, drilling, milling, grinding, shaping, and planning, hobbing.

CO2: Understand and describe various machine tools and equipment for manufacturing

CO3: **M**ake various threads

CO4: Understand the concept of patterns.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	L	H	L	H	-	-	-	-	L	-	L	M	H
CO2	L2	H	L	H	L	H	-	-	-	-	L	-	L	H	M
CO3	L3	H	L	H	L	H	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	CO1, CO2, CO3, CO4

BTMEPCC511 : Machine Design Practice Lab

Course Objectives:

- To understand procedure of machine design and develop an ability to apply it for Cotter Joint Design and Knuckle Joint Design etc.
- To acquire a skill of design and drafting the Bolted joint, Coupling, Cotter joint , Knuckle Joint etc. by using CAD software

List of Exercise

Sessional Work

1 Material selection and relevant BIS nomenclature

2 Selecting fit and assigning tolerances

3 Examples of Production considerations

4 Problems on:

(a) Knuckle & Cotter joints

(b) Torque: Keyed joints and shaft couplings

(c) Design of screw fastening

(d) Bending: Beams, Levers etc.

(e) Combined stresses: Shafts, brackets, eccentric loading.

Course Outcomes:

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

CO1: Apply the knowledge of Design Data Hand Book and ISO standards for selection of materials, strengths, standard dimensions of design components.

CO2: Apply design and drafting knowledge of CAD software for drafting assembly and details of Bolted joint, Coupling, Cotter joint, Knuckle Joint etc.

CO3: Develop Logical and Analytical ability to apply Knowledge of CAD for design of Shaft subjected to direct and combined loading

CO4: Apply skill of design and drafting CAD software for standard welded and riveted joint as per ISO standard. Apply the design knowledge and formulation for safe design

CO5: Apply design procedure for finding the maximum force the given power screw can lift and able to draft and design on CAD software and compare it with analytical results

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	L	-	-	-	-	M	-	L	M	L
CO2	L3	H	L	L	L	L	-	-	-	-	L	-	L	M	M
CO3	L6	H	M	M	M	M	-	-	-	-	M	-	L	M	M
CO4	L3	H	M	M	M	L	-	-	-	-	M	-	L	H	M
CO5	L3	H	L	L	L	L	-	-	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTMEPROJ 512: Industrial Training & Seminar

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To identify, formulate and present model problems.

To find engineering solutions based on a practical approach

Course Outcomes:

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

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Become master in one's specialized technology

CO3: Become updated with all the latest changes in technological world.

CO4: Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTMEHSMC 513: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.

Course Outcomes:

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

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester - VI

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC601	Measurement & Metrology	PCC	30	70	100	3	-	-	3
BTMEPCC602	Computer Aided Design & Analysis	PCC	30	70	100	3	-	-	3
BTMEPCC603	Mechanical Vibrations	PCC	30	70	100	3	-	-	3
BTMEPCC604	Design of Machine Elements II	PCC	30	70	100	3	-	-	3
BTMEPCC605	Research Methodology	PCC	30	70	100	3	-	-	3
BTMEHSMC606.A	Project Management	HSMC (**Elective II**)	30	70	100	3	-	-	3
BTMEHSMC606.B	Finance & Accounting								
BTMEVAC607	Robotics And Automation	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC608	Metrology Lab	LC	60	40	100	-	-	1	1
BTMEPCC609	Vibration Lab	LC	60	40	100	-	-	1	1
BTMEPCC610	Machine Design Practice II Lab	LC	60	40	100	-	-	1	1
BTMEPCC611	Thermal Engineering Lab	LC	60	40	100	-	-	1	1
BTMEPROJ612	Engineering Project-1 (Literature Review)	PROJ	60	40	100	-	-	2	2
BTMEHSMC 613	Social Outreach, Discipline & Extra Curricular Activates	HSMC	100	-	100	-	-	-	1
TOTAL			**610**	**690**	**1300**	**20**	**0**	**6**	**27**

BTMEPCC601: Measurement & Metrology

Course Objectives:

- To understand procedure and importance of measurement in engineering
- To acquire skills of various measuring tools.

Course Contents:

Unit I: **Introduction:** Objective, scope and outcome of the course. Concept of measurement: General concept of measurement, Need for measurement, Generalized measuring system, Units, Standards, Sensitivity, Readability, Range of accuracy, Precision, Accuracy Vs precision, Uncertainty. Repeatability and reproducibility, Errors in measurement, Types of error, Systematic and random error, Calibration, Interchangeability.

Unit II: **Linear and angular measurements:** Linear measuring instruments: Vernier caliper, Micrometer, Interval measurements:- Slip gauges, Checking of slip gauges for surface quality, Optical flat, Application of limit gauges Comparators:- Mechanical comparators, Electrical comparator, Optical comparator, Pneumatic comparator; Sine bar, Use of sine bar, Limitations of sine bars, Sources of error in sine bars, Bevel protractor, Applications of bevel protractor.

Unit III: **Form measurement:** Introduction, Screw thread measurement, Thread gauges, Measurement of gears: Gear errors. Surface finish measurement:-Introduction, Elements of surface texture, Analysis of surface finish, Methods of measuring surface finish, Straightness measurement, Flatness testing, Roundness measurements

Unit IV: **Coordinate measuring machine (CMM):-**Types of CMM, Features of CMM, Computer based inspection, 2 Measurement of power, flow and temperature related properties Measurement of force, Accelerometer, Load cells, Bourdon tube. Torque measurement: Torque measurement using strain gauges, Torque measurement using torsion bars, Mechanical dynamometers.

Unit V: **Measurement of flow:** Variable area meters – Rotameter, Hot wire anemometer, Pitot tube. Temperature measurement, Bimetallic strip, Thermocouples (Thermo electric effects), Thermistors, Pyrometers

Suggested Text / Reference Books:

1. Kalpakjian, S. and Steven R. Schmid, Manufacturing, Engineering & Technology, Pearson.
2. Rao, P.N., Manufacturing Technology–Metal Cutting and Machine Tools, Tata McGraw Hill, New Delhi, 2000.
3. Hajra Chowdary, S.K., and Hajra Chowdary, A.K., Elements of Workshop Technology, Vol. II, Asia Publishing House, Bombay.
4. I.C. Gupta, Engineering Metrology, Dhanpat Rai & Sons.
5. R. K. Jain, Engineering Metrology, Khanna Publishers.

Course Outcomes:

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

CO1: Understand the basic measurement units and calibrate various measuring devices

CO2: Observe error and correction factors of various measuring devices.

CO3: Use load measurement system.

CO4: Understand the coordinate measuring machine and its uses

CO5: Understand the variable area meters

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	H	-	-	-	-	L	-	L	L	M
CO2	L2	H	M	H	M	M	-	-	-	-	L	-	L	M	M
CO3	L3	H	H	M	H	L	-	-	-	-	L	-	L	M	L
CO4	L2	H	L	L	L	L	-	-	-	-	L	-	L	L	M
CO5	L2	H	L	M	L	M	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPCC602: Computer Aided Design & Analysis

Course Objectives:

- To provide an overview of how computers can be utilized in mechanical component design
- To introduce the fundamentals of solid modeling

Course Contents:

Unit I: **Introduction:** Role of computers in design process; Computer aided design, analysis and manufacturing; Computer integrated manufacturing; Popular CAD software used in industry; Input and output devices.

Unit II: **Transformations:** Matrix representation of points, lines and planes; 2D transformation for translation, scaling, rotation and reflection; Homogeneous representation & concatenation; 3D transformations.

Unit III: **Curves and Surfaces:** Representation of curves; Hermite curves, Bezier curves, B- spline curves, Rational curves; Surface modelling – parametric representation, planar surface, surface of revolution, Coons and bicubic patches, Bezier and B-spline surfaces.

Unit IV: **Solid Modelling:** Solid modelling techniques – sweep (linear and curved), Boolean (constructive solid geometry) and other techniques; Solid model representation (Boundary and Constructive Solid Geometry); Medical modelling (pixels, scans and voxels); Exchange standards (IGES, DXF, STEP, STL etc.).

Unit V: **Engineering Analysis:** Introduction to finite element method; Principle of potential energy; FE analysis of 1D element problems (spring, bar, truss elements); Development of element stiffness equation and their assembly; Plain strain and plain stress problems; Domain discretization, pre-processing and post-processing; Verification and validation; Popular CAE software used in industry

Suggested Text / Reference Books:

1. Ibrahim Zeid, “Mastering CAD CAM,” Tata McGraw Hill Publishing Co. 2007.
2. C. McMohan and J. Browne, “CAD/CAM Principles,” Pearson Education, 2nd Edition, 1999.
3. Geometric Modeling, Michael E. Mortenson, Tata McGraw Hill, 2013.
4. W. M. Neumann and R.F. Sproul, “Principles of Computer Graphics,” McGraw Hill, 1989.
5. D. Hearn and M.P. Baker, “Computer Graphics,” Prentice Hall Inc., 1992.

Course Outcomes:

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

CO1: Determine a comprehensive knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems

CO2: Formulate and analyze complex problems to reach substantiated conclusions.

CO3: Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed

CO4: Select and critically evaluate technical literature and other sources of information to solve complex problems.

CO5: Synergize the knowledge of design engineering and computer tools to provide solutions to real-world complex engineering problems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L5	M	H	M	H	L	-	-	-	-	L	-	L	M	H
CO2	L6	M	H	M	L	L	-	-	-	-	L	-	L	L	M
CO3	L4	M	H	M	L	L	-	-	-	-	L	-	L	M	M
CO4	L3	M	H	M	H	L	-	-	-	-	L	-	L	L	M
CO5	L3	H	H	H	L	M	-	-	-	-	L	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPCC603: Mechanical Vibrations

Course Objectives:

- To formulate mathematical models of problems in vibrations using Newton's second law or energy principles,
- To determine solutions to the modeled mechanical vibration problems.
- To correlate results from the mathematical model to physical characteristics of the actual system.
- To design of a mechanical system using fundamental principles developed in the class.

Course Contents:

Unit I: **Introduction:** Objective, scope and outcome of the course. Introduction to Sound: Frequency dependent human response to sound, Sound pressure dependent human response, Relationship among sound power, sound intensity and sound pressure level. Introduction to Noise: Auditory and Non auditory effects of Noise, Major sources of the noise, Industrial noise sources, Industrial noise control strategies. Introduction to Vibration: Importance and scope of vibrations, terminology and classification, Concept of Degrees of freedom, Harmonic motion, vectorial representation, complex number representation, addition.

Unit II: **Undamped Single Degree of Freedom System:** Derivation of equation of motion for one dimensional longitudinal, transverse and Torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy, Compound pendulum and centre of percussion. Damped vibrations of single degree of freedom systems: Viscous damping, under-damped, critically damped and over-damped systems, Logarithmic decrement. Vibration characteristics of Coulomb damped system and Vibration characteristics of Hysteretic damped systems.

Unit III: **Forced Vibrations of Single Degree of Freedom Systems:** Forced vibration with constant harmonic excitation, Steady state and transient parts, Frequency response curves and phase angle plot, Forced vibration due to excitation of support. Vibration Isolation and Transmissibility: Force transmissibility, Motion transmissibility, Forced vibration with rotating and reciprocating unbalance, Materials used in vibration isolation.

Unit IV: **System with Two Degrees of Freedom:** principle mode of vibration, Mode shapes, Undamped forced vibrations of two degrees of freedom system with harmonic excitation, Vibration Absorber, Undamped dynamic vibration absorber and centrifugal pendulum absorber Critical Speed of Shaft: Critical speed of a light shaft without damping, critical speed of shaft having multiple discs, secondary critical speed.

Unit V: **Many Degrees of Freedom Systems (Exact analysis):** Equation of Motion, The matrix method, Eigen Values and Eigen Vectors, Method of influence Coefficients and Maxwell's reciprocal theorem. Torsional vibrations of multi rotor system, vibrations of geared system, Generalized coordinates and coordinate coupling Many Degrees of Freedom Systems (approximate methods): Rayleigh's, Dunkerley's, Stodola's and Holzer's methods Vibrations of continuous systems: Transverse vibration of a string, Longitudinal vibration of a bar, Torsional vibration of a shaft

Suggested Text / Reference Books:

1. Mechanical Vibrations, Rao S.S., Pearson Education.
2. Mechanical Vibrations and Noise Engineering, Ambekar A.G., Prentice Hall India.
3. Mechanical Vibrations, Grover G.K., Nem Chand and Brothers.
4. Theory of Vibrations with Applicaion, Thomson and Dahleh, Pearson Education.
5. Elements of Vibration Analysis, Leonard Meirovitch, Tata McGraw-Hill, New Delhi.
6. Principles of Vibration, Benson H.Tongue, Oxford Publcation.

Course Outcomes:

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

CO1: Determine the equations of motion for free-body diagrams.

CO2: Construct the governing differential equation and its solution for a vibrating mass subjected to an arbitrary force

CO3: Examine any periodic function into a series of simple harmonic motions using Fourier series analysis.

CO4: Solve for the motion and the natural frequency for forced vibration of a single degree of freedom damped or undamped system.

CO5: **S**olve vibration problems that contain multiple degrees of freedom.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L5	H	H	M	H	L	-	-	-	-	L	-	L	M	H
CO2	L6	H	H	M	L	L	-	-	-	-	L	-	L	L	M
CO3	L4	H	H	M	L	L	-	-	-	-	L	-	L	M	M
CO4	L3	H	H	M	H	L	-	-	-	-	L	-	L	L	M
CO5	L3	H	H	H	L	M	-	-	-	-	L	-	L	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPCC604 : Design of Machine Elements II

Objectives:

- To understand design procedures for mechanical power transmission components
- To study power transmitting and power controlling elements

Course Contents:

Unit I: **Introduction:** Objective, scope and outcome of the course. Fatigue Considerations in Design: Variable load, loading pattern, endurance stresses, Influence of size, surface finish, notch sensitivity and stress concentration.

Unit II: Goodman line, Soderberg line, Design of machine members subjected to combined, steady and alternating stresses. Design for finite life, Design of Shafts under Variable Stresses, Bolts subjected to variable stresses.

Unit III: **Design of IC Engine components:** Piston, Cylinder, Connecting Rod and Crank Shaft. Design of helical compression, tension, torsional springs, spring sunder variable stresses.

Unit IV: Design of belt, rope and pulley drive system, Design of gear teeth: Lewis and Buckingham equations, wear and dynamic load considerations. Design and force analysis of spur, helical, bevel and worm gears, Bearing reactions due to gear tooth forces.

Unit V: **Design of Sliding and Journal Bearing:** Methods of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium. Selection of anti-friction bearings for different loads and load cycles, Mounting of the bearings, Method of lubrication.

Suggested Text / Reference Books:

1. Mechanical Machine Design, Bahl and Goel, Standard Publishers Distributors.
2. Design of Machine Elements, Bhandari V.B, Tata McGraw-Hill, New Delhi.
3. Machine Design, Sharma and Aggarwal, Kataria and Sons, Delhi.
4. Mechanical Engg Design, Shigley, Mischke, Budynas and Nisbett, Tata McGraw-Hill
5. Machine Design, Kulkarni S. G., Tata McGraw Hill
6. PSG Design Data Book, P.S.G. College of Technology, Coimbatore.
7. A Text Book of Machine Design, Karwa A., Laxmi Publication.
8. Machine Design, Hall, Holwenko and Laughlin, Schaum's Outlines Series, Tata McGraw Hill.

Course Outcomes:

Upon completion of this course, students will able to:

CO1: Get Knowledge of Fatigue Considerations in Design

CO2: Understand shafts design.

CO3: Understand design of IC Engine components

CO4: Understand design of belt, rope and pulley drive system

CO5: Examine design of gear teeth, Design of sliding & journal bearing

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	H	L	H	H	-	-	-	-	H	-	L	M	M
CO2	L2	H	M	H	M	L	-	-	-	-	M	-	L	M	M
CO3	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M
CO4	L2	H	M	L	M	M	-	-	-	-	M	-	L	H	M
CO5	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPCC605: Research Methodology

Course Objectives:

- To understand some basic concepts of research and its methodologies
- To highlight research problem and parameters

Course Contents:

Unit I: **Foundations of Research:** Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process, Problem Identification & Formulation

Unit II: **Research Design:** Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

Unit III: **Qualitative and Quantitative Research:** Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.

Unit IV: **Sampling:** Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample, Data Analysis: Data Preparation - Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis- Cross tabulations and Chi square test including testing hypothesis of association.

Unit V: **Interpretation of Data and Paper Writing-** Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism

Suggested Text / Reference Books:

1 The Art of Project Management, O'Reilly Media: Cambridge, MA. Berkun, Scott (2008),
2 Making Things Happen: Mastering Project Management, O'Reilly Media: Cambridge, MADesign of Machine Elements, Bhandari V.B, Tata McGraw-Hill, New Delhi.

Course Outcomes:

Upon completion of this course, students will able to:

CO1: Identify appropriate research topics

CO2: Select and define appropriate research problem and parameters.

CO3: Identify and prepare a project proposal (to undertake a project)

CO4: Understand, organize and conduct research (advanced project) in a more appropriate manner

CO5: Write a research report and thesis

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	H	M	H	H	-	-	-	-	H	-	L	M	M
CO2	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	M
CO3	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	M
CO4	L2	M	M	M	M	M	-	-	-	-	M	-	L	H	M
CO5	L2	H	M	H	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEHSMC606.A: Project Management

Objectives:

- To understand the need for Project Management
- To highlight different techniques of activity planning

Course Contents:

Unit I: **Objectives of Project Management-** Importance of Project Management- Types of Projects Project Management Life Cycle- Project Selection – Feasibility study: Types of feasibility Steps in feasibility study.

Unit II: **Project Scope-** Estimation of Project cost – Cost of Capital – Project Representation and Preliminary Manipulations - Basic Scheduling Concepts - Resource Levelling – Resource Allocation

Unit III: **Setting a base line-** Project management Information System – Indices to monitor progress. Importance of Contracts in projects- Teamwork in Project Management - Attributes of a good project team – Formation of effective teams – stages of team formation.

Unit IV: **Project evaluation-** Project Auditing – Phases of project Audit- Project closure reports Guidelines for closeout reports.

Unit V: **Computers, e-markets and their role in Project management-** Risk management Environmental Impact Assessment. Case studies in Project management.

Suggested Text / Reference Books:

1 The Art of Project Management, O'Reilly Media: Cambridge, MA. Berkun, Scott (2008),
2 Making Things Happen: Mastering Project Management, O'Reilly Media: Cambridge, MADesign of Machine Elements, Bhandari V.B, Tata McGraw-Hill, New Delhi.

Course Outcomes:

Upon completion of this course, students will able to:

CO1: Evaluate and select the most desirable projects.

CO2: Apply appropriate approaches to plan a new project and develop project schedule.

CO3: Identify the important risks facing in a new project.

CO4: Understand project evaluation system

CO5: Examine risk assessment

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	H	H	H	H	-	-	-	-	H	-	L	M	M
CO2	L2	L	M	M	M	L	-	-	-	-	M	-	L	M	M
CO3	L2	L	M	M	M	L	-	-	-	-	M	-	L	M	M
CO4	L2	M	M	M	M	M	-	-	-	-	M	-	L	H	M
CO5	L2	L	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEHSMC606.B: Finance & Accounting

Objectives:

- To know the various sources of finance
- To familiarize oneself with the techniques used in financial management.

Course Contents:

Unit-I **Financial Management –** Financial goals - Profit vs. Wealth Maximization; Finance Functions – Investment, Financing and Dividend Decisions – Cost of Capital – Significance of Cost of Capital – Calculation of Cost of Debt – Cost of Preference Capital – Cost of Equity Capital (CAPM Model and Gordon's Model) and Cost of Retained Earnings – Combined Cost of Capital (weighted/Overall).

Unit-II **Capital Budgeting –** Nature of Investment Decisions – Investment Evaluation criteria – Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI), Payback Period, Accounting Rate of Return (ARR) – NPV and IRR comparison.

Unit-III **Operating and Financial Leverage –** Measurement of Leverages – Effects of Operating and Financial Leverage on Profit – Analyzing Alternate Financial Plans - Combined Financial and Operating Leverage – Capital Structure Theories - Traditional approach - M.M. Hypotheses – without Taxes and with Taxes – Net Income Approach (NI) – Net Operating Income Approach (NOI) - Determining capital structure in practice.

Unit- IV **Dividend Policies –** Issues in Dividend Decisions – Relevance Theory – Walter's Model – Gordon's Model – Irrelevance Theory – M-M hypothesis - Dividend Policy in Practice – Forms of Dividends – Stability in Dividend Policy – Corporate Dividend Behaviour.

Unit-V **Management of Working Capital –** Significance and types of Working Capital – Calculating Operating Cycle Period and Estimation of Working Capital Requirements – Financing of Working Capital and norms of Bank Finance – Sources of Working capital – Factoring services– Various committee reports on Bank Finance – Dimensions of Working Capital Management.

REFERENCES

1. Khan MY, Jain PK, BASIC FINANCIAL MANAGEMENT, Tata McGraw Hill, Delhi , 2005.
2. Chandra, Prasanna,. FINANCIAL MANAGEMENT, Tata McGraw Hill, Delhi.
3. Bhabatosh Banerjee, FUNDAMENTALS OF FINANCIAL MANAGEMENT, PHI, Delhi, 2010
4. Chandra Bose D, FUNDAMENTALS OF FINANCIAL MANAGEMENT, PHI, Delhi, 2010
5. Preeti Singh, FUNDAMENTALS OF FINANCIAL MANAGEMENT, Ane, 2011.

Course Outcomes:

Upon completion of this course, students will able to:

CO1: Exemplify to prepare and analyze the financial statements.

CO2: Acquire the basic concept of accounting terms.

CO3: Journalize the ability to rectify the errors in bank reconciliation statement.

CO4: Exposed to various methods of depreciation and insurance accounting.

CO5: Demonstrate insight into single and double entry system of accounting.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	H	H	H	H	-	-	-	-	H	-	L	M	M
CO2	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	M
CO3	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	M
CO4	L2	M	M	M	M	M	-	-	-	-	M	-	L	H	M
CO5	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEVAC607: Robotics And Automation

Objectives:

- To introduce the concepts of Robotic system
- To introduce its components and instrumentation and control related to robotics.

Course Contents:

Unit-I **Basic Concepts in Robotics:** Automation and robotics, Robot anatomy, Basic structure of robots, Resolution, Accuracy and repeatability, and Classification and Structure of robots, Point to point and continuous path systems.

Unit-II **Robotic System and Control Systems:** Components of robotic system, Hydraulic systems, d.c. servo motors, Basic control systems concepts and models, Control system analysis, Robot activation and feedback components. Positional and velocity sensors, actuators. Power transmission systems,

Unit-III **Robot arm Kinematics and Dynamics:** Robot joints, The direct kinematics problem, The inverse kinematics solution, Lagrange-Euler formation, Generalized D'Alembert equations of motion

Unit- IV **Sensors and Instrumentation in robotics:** Tactile sensors, proximity and range sensors, Force and torque sensors, Uses of sensors in robotics. Vision equipment, Image processing, Concept of low level and high level vision

Unit-V **Computer based Robotics:** Method of robots programming, GUI based robotic arm control, Interfacing with computer, communication and data processing, Introduction to Artificial Intelligence

References:

1. Nikku, S.B., Introduction to Robotics, Prentice Hall of India Private Limited–
2. Schilling. R. J., Fundamentals of Robotics: Analysis and Control, Prentice (2006).

Course Outcomes:

Upon completion of this course, students will able to:

CO1: Explain the fundamentals of robotics and its components

CO2: Illustrate the Kinematics and Dynamics of robotics.

CO3: Elucidate the need and implementation of related Instrumentation & control in robotics

CO4: Illustrate the movement of robotic joints with computers/microcontrollers.

CO5: Explain sensors and instrumentation in robotics

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	H	H	H	H	-	-	-	-	H	-	L	M	M
CO2	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	M
CO3	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	M
CO4	L2	H	M	M	M	M	-	-	-	-	M	-	L	H	M
CO5	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPCC608: Metrology Lab

COURSE OBJECTIVES:

- To measure linear and angular dimensions
- To perform various alignment tests on machine tools
- To measure the pressure, flow, speed, displacement and temperature.

List of Experiment

1. Study of various measuring tools like dial gauge, micrometer, Vernier caliper and telescopic gauges.
2. Measurement of angle and width of a V-groove by using bevel protector..
3. To measure a gap by using slip gauges
4. Measurement of angle by using sine bar.
5. Study and use of surface roughness instrument (Taylor Hobson make) Inspection of various elements of screw thread by Tool makers microscope and optical projector.
6. Measurement of gear tooth thickness by using gear tooth Vernier caliper.
7. To check accuracy of gear profile with the help of profile projector.
8. To determine the effective diameter of external thread by using three-wire method.
9. To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat.
10. To plot the composite errors of a given set of gears using composite gear tester.
11. Measurement of coating thickness on electroplated part and paint coating on steel and non-ferrous material using coating thickness gauge.
12. Study and use of hardness tester for rubber and plastics.
13. To check the accuracy of a ground, machined and lapped surface - (a) Flat surface (b) Cylindrical surface.
14. To compare & access the method of small-bore measurement with the aid of spheres.

Course Outcomes:

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

CO1: Demonstrate and use different length measuring instruments like vernier calipers and micrometers

CO2: Explain different angle measuring instrument like universal bevel protractor, sine bar

CO3: Formulate some unknown quantity or parameter of engineering interest.

CO4: Evaluate the surface quality of a given specimen which is important in all kind of manufacturing

CO5: Hands on experience with various measuring instruments to utilize in industries.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	L	L	M	L	-	-	-	-	-	L	-	L	M	M
CO2	L6	H	H	H	H	-	-	-	-	-	H	-	L	M	M
CO3	L4	L	L	M	L	-	-	-	-	-	L	-	L	M	M
CO4	L6	L	L	H	L	-	-	-	-	-	L	-	L	M	M
CO5	L4	H	H	M	H	-	-	-	-	-	H	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTMEPCC609 : Vibration Lab

Course Objectives:

- To understand measurement and analysis techniques of mechanical vibration systems
- To formulate mathematical models of problems in vibrations using Newton's second law or energy principles

List of Experiments

1. To verify relation T = 2π□(l/g) for a simple pendulum.
2. To determine radius of gyration of compound pendulum.
3. To determine the radius of gyration of given bar by using bifilar suspension.
4. To determine natural frequency of a spring mass system.
5. Equivalent spring mass system.
6. To determine natural frequency of free torsional vibrations of single rotor system.
   i. Horizontal rotor
   ii. Vertical rotor
7. To verify the Dunkerley's rule.
8. Performing the experiment to find out damping co-efficient in case of free damped torsional vibration
9. To conduct experiment of trifler suspension.
10. Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies.
11. Study of Vibration measuring instruments.
12. Perform study of the following using Virtual Lab http://www.vlab.co.in/
13. Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural freq and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.
14. Harmonically Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at diff damping ratio and frequency ratio.
15. Perform study of the following using Virtual Lab http://www.vlab.co.in/
16. Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural freq and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.
17. Harmonically Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at diff damping ratio and frequency ratio.

Course Outcomes:

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

CO1: Use frequency and time domain measurement systems and analysis techniques for vibrational systems.

CO2: Construct the equations of motion for free-body diagrams.

CO3: Solve for the motion and the natural frequency of a freely vibrating single degree of freedom undamped motion

CO4: Construct the governing differential equation and its solution for a vibrating mass subjected to an arbitrary force.

CO5: Solve for the motion and the natural frequency for forced vibration of a single degree of freedom damped or undamped system

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	L	M	L	-	-	-	-	-	L	-	L	M	M
CO2	L6	H	H	H	H	-	-	-	-	-	H	-	L	M	M
CO3	L4	H	L	M	L	-	-	-	-	-	L	-	L	M	M
CO4	L6	H	L	H	L	-	-	-	-	-	L	-	L	M	M
CO5	L4	H	H	M	H	-	-	-	-	-	H	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4,CO5

BTMEPCC610 : Machine Design Practice II Lab

Course Objectives:

- To apply measurement and analysis techniques to mechanical compression and tension systems
- To formulate mathematical models and design transmission systems.

Problems on:

Use data hand book by Mahadevan and Reddy

1. Fatigue loading.
2. Helical compression, tension and torsional springs design.
3. Curved Beams.
4. Preloaded bolts and bolts subjected to variable stresses.
5. Belt, Rope and Chain drive system.
6. Gear Design.
7. Sliding contact bearing design.
8. Anti-friction bearing selection

Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project.

- Design of assembly (mechanical systems) using various BIS codes/databook

Course Outcomes:

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

CO1: Understand Fatigue loading and tension in different springs.

CO2: Understand bolts subjected to variable stresses.

CO3: Understand Sliding contact bearing design and Anti-friction bearing selection its applications.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	M	L	L	-	-	-	-	L	-	L	M	M
CO2	L2	H	L	L	L	L	-	-	-	-	L	-	L	M	M
CO3	L2	H	L	H	L	L	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3
CD5	Industrial visit	---

BTMEPCC611: Thermal Engineering Lab

Course Objectives:

- To understand otto and diesel engine technology
- To understand fundamentals of thermodynamics in internal combustion engines.

List of Experiments

1. Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut section models
2. Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models.
3. To draw valve timing diagram for a single cylinder diesel engine.
4. Study of various types of boilers.
5. Study of various types of mountings and accessories.
6. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
7. Study of braking system with specific reference to types of braking system, master cylinder, brake shoes.
8. Study of transmission system including clutches, gear box assembly and differential box

Course Outcomes:

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

CO1: Compute the property of fuels and lubricating oils using suitable tests.

CO2: Demonstrate the performance of internal combustion engines and air compressors

CO3: Interpret the emission characteristics of internal combustion engines

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	L	M	L	L	-	-	-	-	L	-	L	M	M
CO2	L3	H	L	M	L	L	-	-	-	-	L	-	L	H	M
CO3	L4	H	L	H	L	L	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3
CD5	Industrial visit	------

BTMEPROJ612: Engineering Project - I

Course Objective:

- To introduce the concept and methods required for the construction of large software intensive system.
- To develop a broad understanding of the discipline of software engineering and management of software system.
- To provide an understanding of both theoretical and methodological issues Involve in modern software engineering project management and focus strongly on practical techniques

Course Outcomes:

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

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.

CO3: Identify, formulate and model problems and find engineering solution based on a systems approach.

CO4: Capability and enthusiasm for self-improvement through continuous professional development and life-long learning

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO2	L3	M	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO4	L4	M	M	H	L	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTMESODECA 613: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

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

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester - VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPEC701.A	RAC	Professional Elective I	30	70	100	3	-	-	3
BTMEPEC701.B	Power Plant Engineering								
BTMEPEC702.A	Additive Manufacturing	Professional Elective II	30	70	100	3	-	-	3
BTMEPEC702.B	Finite Element Analysis								
BTMEOEC703.A	CIMS	Open Elective I	30	70	100	3	-	-	3
BTMEAOEC703.B	Power Generation Sources								
BTMEOEC704.A	Industrial Engineering	Open Elective II	30	70	100	3	-	-	3
BTMEOEC704.B	Non-Destructive System								
BTMEPCC705	Production & Operation Management	PCC	30	70	100	3	-	-	3
BTMEHSMC 706	Leadership & Management Skills	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC707	Industrial Engineering Lab	LC	60	40	100	-	-	1	1
BTMEAPCC708	RAC Lab	LC	60	40	100	-	-	1	1
BTMEAPCC709	CIMS Lab	LC	60	40	100	-	-	1	1
BTMEPROJ710	Industrial Training	PROJ	60	40	100	-	-	2	2
BTMEPRJ711	Engineering Project-2 (Design & Analysis)	PROJ	60	40	100	-	-	2	2
BTMEHSMC 712	Social Outreach, Discipline & Extra Curricular Activity	HSMC	100	-	100	-	-	-	1
TOTAL			**580**	**620**	**1200**	**17**	**0**	**7**	**25**

BTMEPEC701.A: Refrigeration and Air Conditioning

Course Objectives:

- To familiarize with the terminology associated with refrigeration and conditioning.
- To understand the basics of refrigerator.

Course Contents:

Unit I: **Introduction:** Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.

Vapour Compression Refrigeration System: Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions

Multiple Evaporator and compressor system: Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.

Unit II: **Gas Cycle Refrigeration:** Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative heat exchanger. Air cycle for air craft: Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle.

Unit III: **Other refrigeration systems** (description only): Vapour absorption refrigeration system, Electrolux refrigerator, Lithium Bromide – Water system, Water vapour refrigeration system, Vortex tube refrigeration system, thermo electric refrigeration system.

Refrigerants: Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants. Refrigeration Equipments: Compressor, condenser, evaporator, expansion devices, types & working.

Unit IV: **Psychrometry:** Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor, Apparatus Dew point temperature and air washers.

Human Comfort: Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.

Unit V: **Cooling load calculations:** Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling.

Selection of air conditioning: Apparatus for cooling and dehumidification, Air conditioning system, year round air conditioning.

Text Book

1 Arora, C.P., Refrigeration and Air Conditioning, Tata McGraw Hill

Reference Books

1 Stoecker W.F., "Refrigeration & Air Conditioning" McGraw Hill Publication. **2000**

2 Andrew D. Althouse., "Modern Refrigeration & Air Conditioning" GoodHeart-Willcox Co.**2002**

3 Jorden & Priester, Refrigeration & Air Conditioning, Prentice Hall of India. **2003**

4 Roy J. Dossat, Principal of Refrigeration, Pearson Education, New Delhi. **2014**

5 Edward G. Pita, Air Conditioning Principles and Systems, Pearson Education, New Delhi.**2003**

6 Jain V.K., Refrigeration & Air Conditioning, Tata McGraw Hill New Delhi. 2004

Course Outcomes:

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

CO1: Understand various types of refrigeration cycles.

CO2: Analyze the effect of various fuel operating variables on refrigeration

CO3: Identify alternative refrigerants and their uses

CO4: Understand psychometric properties

CO5: Evaluate performance & psychometric calculation

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	M	-	-	-	-	L	-	L	M	L
CO2	L4	H	M	H	M	M	-	-	-	-	L	-	L	M	M
CO3	L2	H	H	H	H	M	-	-	-	-	L	-	L	L	M
CO4	L2	H	H	H	H	M	-	-	-	-	L	-	L	H	M
CO5	L5	H	M	H	M	M	-	-	-	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEPEC701.B: Power Plant Engineering

Course Objectives:

- To understand and explain the economics involved in Power Plant and identify the factors related to selection of plant
- To acquire skills of design and drafting different aspect of plant engineering in digital era

Course Contents:

Unit I: Introduction Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion calculations. Load estimation, load curves, various terms and factors involved in power plant calculations. Effect of variable load on power plant operation, Selection of power plant units. Power plant economics and selection, Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection

Unit II: Steam power plant General layout of steam power plant, Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systems such as coal handling system, pulverizes and coal burners, combustion system, draft, ash handling system, Dust collection system, Feed water treatment and condenser and cooling towers and cooling ponds, Turbine auxiliary systems such as governing, feed heating, reheating , flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, Site selection of a steam power plant.

Unit III: Diesel power plant General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance, Site selection of diesel power plant, Comparative study of diesel power plant with steam power plant. Gas turbine power plant Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants, Site selection of gas turbine power plant.

Unit IV Nuclear power plant Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, Nuclear waste disposal, Site selection of nuclear power plants. Hydro electric station Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems. Non Conventional Power Plants Introduction to non-conventional power plants (Solar, wind, geothermal, tidal) etc**. Unit V:** Electrical system Generators and generator cooling, transformers and their cooling, bus bar, etc. Instrumentation Purpose, classification, selection and application, recorders and their use, listing of various control rooms. Pollution Pollution due to power generation

Suggested Text / Reference Books:

1. Computer Aided manufacturing, Chang and Wang, Pearson Publisher.
2. Automation Production Systems and Computer Integrated manufacturing, Grover M.P., Pearson Publisher. 44
3. CAD/CAM: Principles and Applications, Rao P.N., McGraw-Hill Publication.
4. Computer Control of Manufacturing System, Koren Y., McGraw-Hill Publication.
5. Computer Aided Manufacturing, Rao and Khundra, McGraw-Hill Publication.
6. Computer Numerical Control: Machining and Turning Center, Ruesada and Jeyapoovan, Pearson Publisher.

Course Outcomes:

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

CO1. Describe the electrical, instrumentation & pollution control systems used in power plants

CO2. Discuss various components of steam power plant and the factors influencing the site selection for the plant.

CO3. Describe the working of various components of diesel power plant and compare it with steam power plant.

CO4. Illustrate the working of gas turbine power plant and its components.

CO5. Explain the components, principles and working of nuclear & non-conventional power plant.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	L	H	L	-	-	-	-	-	L	-	L	M	M
CO2	L3	L	L	M	L	L	-	-	-	-	L	-	L	L	M
CO3	L3	H	L	M	L	L	-	-	-	-	L	-	L	H	M
CO4	L6	L	L	M	L	L	-	-	-	-	L	-	L	L	L
CO5	L6	M	M	H	M	L	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEPEC702.A: Additive Manufacturing

Course Objectives:

- To introduce students the basics of additive manufacturing/rapid prototyping and its applications in various fields, reverse engineering techniques.
- To familiarize students with different processes in rapid prototyping systems.

Course Contents:

Unit-I **Introduction:** Objective, scope and outcome of the course.
Overview of Rapid Product Development (RPD): Need for the compression in product development, history of RP systems, Definition of RPD; Components of RPD. Rapid Prototyping (RP);Principle of RP; Technologies and their classifications.

Unit-II **Stereo Lithography Systems**: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.
Selective Laser Sintering& Fusion Deposition Modelling: Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications. Fusion Deposition Modeling: Principle, Process parameter, Path generation, Applications.

Unit-III **Solid Ground Curing**: Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application.
Selection of RP process; Issues in RP; Emerging trends. **Rapid Tooling (RT):** Introduction to RT, Indirect RT process-Silicon rubber molding, Epoxy tooling, Spray metal tooling and Investment Casting, Cast kirksite, 3Q keltool, etc.

Unit-IV **Direct RT processes**: Laminated Tooling, Powder Metallurgy based technologies, Welding based technologies, Direct patternmaking (Quick Cast, Full Mold Casting), Emerging Trends in RT, Reverse Engineering: Geometric data acquisition, 3D reconstruction, Applications and Case Studies, Engineering applications, Medical applications.

Unit-V Processing Polyhedral Data: Polyhedral B-Rep modeling, STL format, Defects and repair of STL files, Introduction to software for RP : Brief overview of Solid view, magics etc.

Suggested Text / Reference Books:

1. Additive Manufacturing Technologies by Ian Gibson and David Rosen
2. Design for Additive Manufacturing by Dr Tom Page
3. Additive Manufacturing: Advanced Manufacturing Technology in 3d Print Deposit by Sabrie Soloman

4. The 3D Printing Bible: Everything You Need To Know About 3D Printing by Jerry Rogers

Course Outcomes:

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

CO1: Apply conceptual design and geometric transformation techniques in rapid prototyping.

CO2: Know about STL system and STL fusion deposition modeling.

CO3: Identify solid ground curing methods and rapid tooling methods.

CO4: Determine direct rapid tooling processes and their emerging trends.

CO5: Understand processing polyhedral data

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	H	H	H	H	-	-	-	-	L	-	L	M	M
CO2	L1	H	M	H	M	M	-	-	-	-	L	-	L	M	M
CO3	L2	H	H	H	H	M	-	-	-	-	L	-	L	M	M
CO4	L5	H	H	M	H	L	-	-	-	-	L	-	L	M	M
CO5	L4	H	L	H	L	M	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTMEPEC702.B: Finite Element Analysis

Course Objective:

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems
- To analyze a physical problem, develop experimental procedures for accurately investigating the problem, and effectively perform and document findings.

Course Contents:

Unit-I **Introduction:** Objective, scope and outcome of the course.
Introduction to FEM, Application of FEM, Advantages of FEM, FEA Software.
Steps of FEM: Discretization, Local stiffness matrix, coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix, Banded symmetric matrix and bandwidth.

Unit-II **One-dimensional Finite Element Analysis:** Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, Finite element model concept, Derivation of finite elements equations using potential energy approach for linear and quadratic 1-D bar element.
Shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain, Problems on 1-D structural analysis.

Unit-III **Two Dimensional Finite Element Analysis:** Finite element formulation using three nodded triangular (CST) element, Plane stress and Plane strain problems,
Shape functions, node numbering and connectivity, Assembly, Boundary conditions, Problems on 2-D structural analysis.

Unit-IV Finite Element Formulation from Governing Differential Equation: Galerkin FEM method.
Application to one dimensional structural problems, one-dimensional heat transfer problems, etc., Introduction to variational formulation (Ritz Method.)

Unit-V **Higher Order Elements:** Lagrange's interpolation formula for shape functions, Convergence of solution, static condensation, p and h methods of mesh refinement, Aspect ratio.

Suggested Text / Reference Books:

1. Text Book of Finite Element Analysis, Seshu P., Prentice Hall India.
2. Finite Element Procedure in Engineering Analysis, Bathe K.J., Prentice Hall India.
3. An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw-Hill, New Delhi.
4. Concepts & Applications of Finite Element Analysis, Cook and Plesha, Willey India New Delhi.
5. Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall India.

Course Outcomes:

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

CO1: Understand different mathematical techniques used in FEM analysis.

CO2: Understand the stress and strain role and significance of shape functions in finite element formulations and use linear, quadratic functions for interpolation.

CO3: Understand the concepts of Nodes and elements.

CO4: Understand the application of FEA in heat transfer problem

CO5: Learn finite element modeling techniques

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	H	-	-	-	-	L	-	L	H	M
CO2	L2	H	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L2	H	L	L	L	L	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	H	L	M	-	-	-	-	L	-	L	H	M
CO5	L1	H	L	H	L	M	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEOEC703.A: Computer Integrated Manufacturing Systems

Course Objectives:

- To understand procedure of integration between different manufacturing modules
- To acquire skills of design and drafting different aspect of production in digital era

Course Contents:

Unit I: **Introduction:** Objective, scope and outcome of the course. Introduction to CIM: Overview of Production Systems, the product cycle, Automation in Production Systems, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Numerical Control (NC): Basic components of an NC system, coordinate system and motions control systems. Computer Numerical Control (CNC): features of CNC, machine control unit, CNC software. Direct Numerical Control and Distributed Numerical Control. Applications, advantages and disadvantages of NC. Adaptive control of machining system.

Unit II: **NC Part programming:** Manual and computer assisted part programming, Part programming with APT. NC part programming using CAD/CAM software. NC cutter path verification.

Unit III: **Computer Aided Process Planning:** Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data systems, computer generated time standards.

Group Technology: Introduction, part families, part classification and coding, coding system and machining cells.

Unit IV: **Computer Aided Production Management Systems:** Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, and computer process control. Computer Aided Quality Control; Computer in quality control, contact inspection methods, Non contact inspection methods, optical and non optical computer aided testing.

Unit V: Computer Aided Material Handling; Computer control on material handling, conveying, picking. Ware house control, computerized material handling for automated inspection and assembly. Computer Integrated Manufacturing Systems: Introduction, type's special manufacturing systems, flexible manufacturing systems(FMS).Collaborative Engineering; Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.

Suggested Text / Reference Books:

7. Computer Aided manufacturing, Chang and Wang, Pearson Publisher.
8. Automation Production Systems and Computer Integrated manufacturing, Grover M.P., Pearson Publisher. 44
9. CAD/CAM: Principles and Applications, Rao P.N., McGraw-Hill Publication.
10. Computer Control of Manufacturing System, Koren Y., McGraw-Hill Publication.
11. Computer Aided Manufacturing, Rao and Khundra, McGraw-Hill Publication.
12. Computer Numerical Control: Machining and Turning Center, Ruesada and Jeyapoovan, Pearson Publisher.

Course Outcomes:

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

CO1. Identify key decision areas for operating managers and researchers for design of production planning & control systems

CO2. Understand NC programming.

CO3. Understand Computer Aided Process Planning

CO4. Design computer aided production management systems

CO5. Design factory systems for shop floor control, production scheduling, aggregate planning and capacity planning.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	H	L	-	-	-	-	-	L	-	L	M	M
CO2	L3	H	L	M	L	L	-	-	-	-	L	-	L	L	M
CO3	L3	H	L	M	L	L	-	-	-	-	L	-	L	H	M
CO4	L6	H	L	M	L	L	-	-	-	-	L	-	L	L	L
CO5	L6	H	M	H	M	L	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTMEOEC703.B: Power Generation Sources

Course Objectives:

- To understand different types of power plant engineering.
- To familiarize with the working of power plants based on different fuels.

Course Contents:

Unit-I **INTRODUCTION:** World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Environment - Economy - Energy and Sustainable Development, Energy planning.

Conventional Energy Generation Methods: Thermal Power plants: Basic schemes and working principle. Gas Power Plants: open cycle and closed cycle gas turbine plants, combined gas & steam plants-basic schemes. Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants. Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants.

Unit-III **SOLAR ENERGY:** Basic concepts, Solar radiation – Measurement, Solar thermal systems – Flat plate and concentrating collectors, Solar passive space - Solar heating and cooling techniques – Solar desalination – Solar Pond - Solar cooker - Solar dryers-Solar furnaces - Solar pumping, Solar green house- Solar thermal electric power plant – Solar photo voltaic conversion – Solar cells – PV applications, Hybrid systems.

Unit-IV **WIND ENERGY:** Introduction-Availability- Wind power plants , Power from the wind, Wind energy conversion systems, site characteristics, Wind turbines types – Horizontal and vertical axis-design principles of wind turbine – Blade element theory, Magnus effect- Performance. Wind energy Applications – Hybrid systems, Wind energy storage, Safety and environmental aspects.

Unit-V **BIOMASS ENERGY:** Biomass – usable forms- composition- fuel properties – applications, Biomass resources, Biomass conversion technologies - direction combustion - pyrolysis – gasification -anaerobic digestion, Bioethanol and Biodiesel Production - Economics - Recent developments. Energy farming, Biogas technology - Family biogas plants, Community and institutional biogas plants – design consideration – applications.

OTHER RENEWABLE ENERGY SOURCES: Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Social and environmental aspects. Fuel cell technology - types, principle of operation – applications. Hydrogen energy production - Storage – transportation – utilization.

Suggested Text / Reference Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

Course Outcomes:

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

CO1 Understand basic knowledge of Different types of Power Plants and site selection

CO2 Design ash handling and coal handling methods in a the thermal power plant.

CO3 Calculate performance of thermal power plant.

CO4 Understand the working of Hydroelectric and Nuclear power plant

CO5 Understand the working of Diesel & Gas Turbine Power plant

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	H	-	L	-	-	H	-	L	H	M
CO2	L6	H	M	H	M	M	L	L	-	-	M	-	L	H	M
CO3	L3	H	H	H	H	M	-	L	-	-	H	-	L	L	L
CO4	L2	H	H	H	H	M	-	L	-	-	H	-	L	M	M
CO5	L2	H	M	H	M	M	-	L	-	-	M	-	L	H	H

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Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEOEC704.A: Industrial Engineering

Course Objectives:

- To understand different aspects of industrial engineering.
- To familiarize with the working of management and different levels of an organization.

Course Contents:

Unit I: Management theory and Functions

Management Theory and Functions: Evolution of management, scientific management, Contribution to scientific management: Taylor, Fayol, Mayo, Levels of 'Management Administration and Management, functions of management.

Unit II: Production Planning & control:

Types of production; Function of production planning and control; planning preplanning, sales forecasting short term forecasting ,long forecasting , Routing ,Scheduling ,Dispatching and control with other departments.

Unit III : Financial Management and Depreciation :

Introduction, Needs of Finance, Kinds of Capital Sources of fixed capital, Financial ratio: Liquidity ratio, Profits investment ratio, equity ratio, inventory ratio. Depreciation: Meaning and causes. Need of Depreciation calculation, Methods of Depreciation: Straight line Methods. Sinking funds methods.

Unit IV: Plant location and layout:

Selection of site ,layout contributing factors ,types of layout facilities available from Govt. and autonomous agencies , material management and ABC Analysis, Material handling system and equipments

Unit V: Wage and incentives, Labour Relations and Legislation

Charactertics of a good wage or incentive system, method of wage payment, concept of wage incentive schemes: finnancial and non –financial. Labour relations and legislation: Profit sharing, fringe benefits etc. Trade Unions.

Methods of setting disputes (i) Collective bargaining (ii) Conciliation (iii) Mediation (iv) Arbitration industrial disputes in India, Machinery for setting disputes. The factory Act

Recommended reference Books:

1. Industrial engineering by Hicks
2. Financial management by Prasanna Chandra
3. Motion and Time Study by Barns
4. Work Study by ILO

Course Outcomes:

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

CO1- Apply discipline knowledge and provide effective leadership to derive solutions to problems/challenges within an organization.

CO2- Effectively and productively participate in teams.

CO3- Recognize organizational processes and behaviors.

CO4- Evaluating the impact of these solutions in the broader context of the organization and society.

CO5- Apply advanced level Knowledge of methodological and computational skills with which able to operate (apply) effectively.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	H	-	L	-	-	H	-	L	H	M
CO2	L6	H	M	H	M	M	L	L	-	-	M	-	L	H	M
CO3	L3	L	H	L	H	M	-	L	-	-	H	-	L	L	L
CO4	L2	M	H	M	H	M	-	L	-	-	H	-	L	M	M
CO5	L2	H	M	H	M	M	-	L	-	-	M	-	L	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEOEC704.B: Non Destructive System

Course Objectives:

- To familiarize with the different testing machines.
- To understand the basics of non destructive tastings.

Course Contents:

Unit-I **Introduction:** Objective, scope and outcome of the course

Overview of NDT: NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection, Unaided and aided.

Unit-II **Surface Non Destructive Evaluation (NDE) Methods:** Liquid Penetrant Testing, Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods. Testing Procedure, Magnetic Particle Testing, Theory of magnetism, inspection materials. Magnetisation methods, Interpretation and evaluation, Principles and methods of demagnetization, Residual magnetism.

Unit-III **Thermography and Eddy Current Testing (ET):** Thermography, Principles, Contact and non contact inspection methods, Advantages and limitation, Instrumentations and methods, applications. Eddy Current Testing, Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

Ultrasonic Testing (UT) and Acoustic Emission (AE): Ultrasonic Testing, Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-Scan, B-scan, C-scan. Acoustic Emission Technique, Principle, AE parameters, Applications.

Unit-IV **Radiography (RT):** Principle, Interaction of X-Ray with matter, imaging, film and film less techniques, Types and use of filters and screens, Geometric factors, Inverse square, law, characteristics of films, Interpretation/ Evaluation, Fluoroscopy, Xero Radiography, Computed Radiography, Computed Tomography.

Unit-V **Special Techniques and Applications:** Phased array ultrasonic time of flight diffractions, Automated and remote ultrasonic testing, Acoustic pulse reflectometry, Alternative current field method, Case studies on NDT techniques used in aircrafts.

Suggested Text / Reference Books:

1. Non - Destructive Testing. Mr. T.Raja
2. Basics of Non-Destructive Testing. Lari.
3. Non-Destructive Testing Techniques. Ravi Prakash.
4. Non-Destructive Test and Evaluation of Materials. J Prasad.

Course Outcomes:

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

CO1: Understand various theories of testing process and machines

CO2: DescribeSurface Non Destructive Evaluation

CO3: Interpret Thermography and Ultrasonic Testing

CO4: Understand radiographic testing

CO5: Understand alternative current field method testing

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	M	H	H	-	-	-	-	H	-	L	M	M
CO2	L2	H	M	H	M	M	-	-	-	-	M	-	L	M	M
CO3	L4	H	H	M	H	M	-	-	-	-	H	-	L	M	M
CO4	L2	H	H	M	H	M	-	-	-	-	H	-	L	M	M
CO5	L2	H	M	M	M	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEPCC705: Production & Operation Management

Course Objectives:

- To familiarize the students with the role of operations and its interaction with other activities of a firm and their integration in a highly competitive global environment
- To enable the students to apply the understanding of production processes in quantitative analysis of problems arising in the management of operations.

Course Contents:

Unit-I **Introduction to Operations Management:** Definition, need, key decisions of OM, goods vs. services. Operations as a key functional area in an organization; Operation Strategies: Definition, relevance, strategy formulation process; Maintenance Management: Need of maintenance management, equipment life cycle (Bathtub curve), measures for maintenance performance (MTBF, MTTR and availability).Lean production: Definition of lean production, lean Demand Pull logic, waste in operations, 2 card kanban Production Control system; Process Selection: Definition, Characteristics that influence the choice of alternative processes (volume and variety), type of processes- job shop, batch, mass and continuous.

Unit-II **Layout Decision:** Layout planning, Benefits of good layout, importance, different types of layouts (Process, Product, Group technology and Fixed position layout). Assembly line balancing by using LOT rule; Facility Location: Objective, factors that influence location decision, location evaluation methods- factor rating method. Capacity planning: Definition, input and output measures of capacity, types of capacity planning over time horizon. Decision trees analysis for capacity planning.

Unit-III **Forecasting:** Definition, types, qualitative (grass roots, market research and Delphi method) and quantitative approach (simple moving average method, weighted moving average and single exponential smoothing method), forecast error, MAD, issues related with forecasting in services;

Unit-IV **Aggregate Planning:** Definition, nature, strategies of aggregate planning, methods of aggregate planning- level plan, chase plan and mixed plan (keeping in mind demand, workforce and average inventory); Scheduling: Operation scheduling, goals of short term scheduling, job sequencing (FCFS, SPT, EDD, LPT, CR) & Johnson's rule on two machines, Gantt charts.

Unit-V **Statistical Quality control:** Variations in process (common & assignable causes); Control charts: Variable measures (mean and range chart), Attribute measures (proportion of defects and no. of defects) using control tables; Elementary Queuing Theory: need of queuing theory in service and manufacturing operations, Poisson-Exponential Single Server Model with Infinite Population.(M/M/1 queuing model).

Textbooks:

1. Mahadevan, B, Operations Management: Theory & Practice, 3rd ed., Pearson Education.
2. Russell& Taylor, Operations & Supply Chain Management (International Student Version), 8 th ed., Wiley.
3. MohanMan, GuptaP. K., SwarupKanti, Introduction to Management Science Operations Research, 19th ed. Sultan Chand & Sons.
4. Kapoor V.K., Operations Research: Quantitative Techniques for Management, 9 ed., Sultan Chand & Sons.

Course Outcomes:

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

CO1: Understand the role of operations management in achieving organizational competitiveness

CO2: Appreciate the concepts of lean production and maintenance management in operations.

CO3: Comprehend key decision areas of operations and analyze data for effective decision making in operations management

CO4: Develop an understanding on how to create a production entity with focus on Production Base

CO5: Develop an understanding on how to create a production entity with focus on Technical and Operational capabilities

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	**Bloom Level**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**P011**	**PO12**	**PSO 1**	**PSO 2**
CO1	L2	H	H	M	H	H	-	-	-	-	H	-	L	H	M
CO2	L2	M	M	H	M	M	-	-	-	-	M	-	L	M	M
CO3	L4	M	H	M	H	M	-	-	-	-	H	-	L	M	M
CO4	L2	M	H	M	H	M	-	-	-	-	H	-	L	M	M
CO5	L2	M	M	M	M	M	-	-	-	-	M	-	L	M	M

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Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEHSMC706: Leadership & Management Skills

Objectives:

- To develop essential skills to influence and motivate others.
- To inculcate emotional and social intelligence and integrative thinking for effective leadership.
- To create and maintain an effective and motivated team to work for society.
- To nurture a creative and entrepreneurial mindset.
- To make learners understand personal values and apply ethical principles in professional and social contexts.
- To familiarize the learners with the budgeting process and make them conscious of the significance of budgeting, savings, and investment.

Course Content:

Unit I: Leadership Skills
Understanding Leadership and Its Importance, Models of Leadership, Basic Leadership Skills.

Unit II: Managerial Skills
Basic Managerial Skills, Self-management Skills, Emotional Quotient, Developing Self-Awareness with JOHARI Window

Unit III: Entrepreneurial Skills
Basics of entrepreneurship, creating a Business Plan

Unit IV: Innovative Leadership and Design Thinking
Innovative leadership, Design thinking

Unit V: Ethics and Integrity & Managing Personal Finance
Ethics and Integrity: Learning through biographies, Ethics and Conduct
Managing Personal Finance: Budgeting, Saving and investing

Reference Books:

1. Ashokan, M. S. (2015). Karmayogi: A Biography of E. Sreedharan. Penguin Random House, London, UK
2. Ackerman, C. E. (2022, November 23). 87 self-reflection questions for introspection [+exercises]. PositivePsychology.com. https://positivepsychology.com/introspection-selfreflection.
3. Hisrich, R. D., Peters, M. P., and Shepherd D. A. (2017). Entrepreneurship. 10th Ed. McGraw Hill Education
4. Kelly, D. (2012). How to Build Your Creative Confidence [Video]. TED Talk. https://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence.
5. Nellickappilly, S. (n.d). Ethics. [Video]. NPTEL. https://nptel.ac.in/courses/109/106/109106117/.
6. Chandra, A. (n.d). NPTEL course on Behavioural and Personal Finance (Lectures 23 and 24). [Video]. NPTEL. https://nptel.ac.in/courses/110/105/110105144/.

Course Outcomes:

	The learners shall be able to:
CO1	Examine various leadership models and understand/assess their skills, strengths and abilities that affect their leadership style and can create their leadership vision.
CO2	Learn and demonstrate a set of practical skills such as time management, self-management, handling conflicts, and team leadership
CO3	Understand the basics of entrepreneurship and develop business plans.
CO4	Apply the design thinking approach for leadership.
CO5	Appreciate the importance of ethics and moral values for the making of a balanced personality. Allocate their available funds judiciously, maintain an account of their current expenses and plan for savings and investments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Bloom's Levels**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L4	-	-	-	-	-	-	-	-	**H**	**L**	**L**	**M**	**M**	**M**
CO2	L3	-	-	**L**	**L**	-	-	-	-	**M**	**M**	**M**	**M**	**M**	**M**
CO3	L3	-	-	-	-	-	-	-	-	-	-	**H**	**H**	**M**	**M**
CO4	L3	-	-	**H**	-	-	-	-	-	**H**	-	-	**H**	**M**	**M**
CO5	L3	-	-	-	-	-	-	-	**H**	-	-	**H**	-	**M**	**M**

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO1,CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4
CD5	Industrial visit	-

BTMEPCC707: Industrial Engineering Lab

Course Objectives:

- To understand the various industrial engineering working tools and their uses.
- To impart knowledge to develop a product within the range of acceptance.

List of Experiment

1. Determination of time standard for a given job using stopwatch time-study.
2. Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.
3. Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint.
4. To perform ABC analysis for the given set of inventory data.
5. To develop Bill of Materials/Product structure tree and calculate planned order release (POR) using MRP format
6. To solve the operations research problems on Linear programming/Transportation/ Assignment etc. using OR software's like TORA/LINGO/LINDO/SAS/EXCEL SOLVER etc.
7. Simulation of inventory system/Queuing system/production system using Monte-Carlo method.
8. To perform case study on sales forecasting.
9. To perform case study on project management using PERT/CPM.
10. To perform a case study on plant location and layout planning.
11. To perform a case study on capacity planning.

Course Outcomes:

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

CO1: Evaluate and design a system, component, or process to meet desired needs within realistic constraints

CO2: Identify the control charts.

CO3: Draw and calculate the different charts and diagrams.

CO4: Identify the standard deviations.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L5	H	M	H	M	H	-	-	-	-	M	-	L	M	M
CO2	L2	H	L	H	L	H	-	-	-	-	L	-	L	M	L
CO3	L3	H	M	H	M	H	-	-	-	-	M	-	L	M	M
CO4	L1	H	M	H	M	H	-	-	-	-	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	CO1,CO2, CO3, CO4

BTMEPCC708: RAC Lab

Course Objectives:

- To understand the importance of refrigeration
- To get the knowledge of various conditioning properties.

List of Experiments:

1. To find out the Coefficient of performance of a Heat pump.
2. To find out the Coefficient of performance of a device, which is working on vapour absorption cycle?
3. To find out the Coefficient of performance of a refrigerator and also find the sensible heat factor.
4. To study about the evaporative cooler.
5. To perform experiment on three ton air conditioner test rig.
6. To study about the air distribution system.
7. To calculate the heat load for a given setup.
8. To study about the central air conditioning plant.
9. To study about the solar refrigeration system.

Course Outcomes:

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

CO1: Demonstrate the ability Coefficient of performance of a device

CO2: Examine and calculate the heat load

CO3: Calculate coefficient of performance of a refrigerator

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	M	M	M	M	L	-	-	-	-	M	-	L	-	M
CO2	L4	M	M	M	M	M	-	-	-	-	M	-	L	-	M
CO3	L3	M	M	M	M	M	-	-	-	-	M	-	L	-	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3
CD5	Industrial visit	CO1,CO2, CO3

BTMEPCC709: CIMS Lab

Course Objectives:

- To introduce different concepts of part programming.
- To understand the working of computer numerical control.

List of Experiments

1. To prepare part programming for plain turning operation.
2. To prepare part program for turning operations using turning cycle.
3. To prepare part program for threading operation.
4. To prepare part program for gear cutting using mill cycle.
5. To prepare part program for multiple drilling in X and Z axis using drilling cycle.

Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project.

- Engraving of students' name, manufacturing of a part.

Course Outcomes:

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

CO1: Apply knowledge about Computer Aided Quality control and Process Planning Control.

CO2: Design Flexible manufacturing cell after carrying out Group technology study and finally creating FMS.

CO3: Apply knowledge about various methods of communication in CIMS.

CO4: Apply data management and its importance for decision making in CIMS environment.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	M	L	L	L	L	M	-	-	-	L	-	L	M	M
CO2	L6	L	L	L	L	-	L	-	-	-	L	-	M	M	M
CO3	L3	M	H	H	H	-	M	-	-	-	L	-	M	M	L
CO4	L3	L	M	M	M	L	M	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	CO1, CO2, CO3, CO4

BTMEPROJ710: Industrial Training & Seminar

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To identify, formulate and present model problems.
- To find engineering solutions based on a practical approach

Course Outcomes:

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

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Become master in one's specialized technology

CO3: Become updated with all the latest changes in technological world.

CO4: Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

BTMEPROJ711: Engineering Project - II

Course Objective:

- To introduce the concept and methods required for the construction of large software intensive system.
- Todevelopabroadunderstandingofthedisciplineofsoftwareengineeringandmanagementofsoftwaresystem.
- To provide an understanding of both theoretical and methodological issues involve inmodernsoftwareengineeringprojectmanagementandfocusstronglyonpracticaltechniques

Course Outcomes:

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

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.

CO3: Identify, formulate and model problems and find engineering solution based on a systems approach.

CO4: Capability and enthusiasm for self-improvement through continuous professional development and life-long learning

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO2	L3	M	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO4	L4	M	M	H	L	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTMESODECA 712: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

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

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester - VIII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPEC801.A	Automobile Engineering	Professional Elective III	30	70	100	3	-	-	3
BTMEPEC801.B	Renewable Energy Engineering								
BTMEOEC802.A	Product Innovation & Entrepreneurship	Open Elective III	30	70	100	3	-	-	3
BTMEOEC802.B	Energy Management								
BTMEOEC802.C	Waste and By-product Utilization								
BTMEOEC802.D	Medium And Small Enterprises Management								
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC803	FEA Lab	LC	60	40	100	-	-	1	1
BTMEPCC804	Automobile Engineering Lab	LC	60	40	100	-	-	1	1
BTMEPROJ805	Engineering Project-3 (Testing & Prototype)	PROJ	120	80	200	-	-	4	4
BTMEHSMC 806	Social Outreach, Discipline & Extra	HSMC	100	-	100	-	-	-	1
TOTAL			**400**	**300**	**700**	**6**	**0**	**6**	**13**

BTMEPEC801.A: Automobile Engineering

Course Objectives:

- To understand the construction of various parts of an automobile
- To understand the working principle of various parts of an automobile

Course Contents:

Unit I **Introduction:** Objective, scope and outcome of the course. Frame & Body: Layout of chassis, types of chassis frames and bodies, their constructional features and materials. Clutches: single plate, multi-plate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches. Fluid coupling. Brakes: Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials.

Unit II **Gear Boxes:** Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter; Drives: Overdrive, Propeller shaft, Universal joints, Differential; Rear axle drives. Hotchkiss and torque tube drives; Rear axle types; Front wheel and All wheel drive.

Unit III **Wheels and Tyres:** Tyre types, Tyre construction; Tyre inflation pressure, Tyre wear and their causes; Re-treading of the tyre, Steering system: steering gear boxes, Steering linkages, Steering mechanism, Under and Over steering. Steering Geometry, Effect of camber, caster, king pin inclination, toe in and toe out; Power steering; Integral and linkage types, Suspension system: objective and requirements, Suspension spring, front and rear suspension systems, Independent suspension system Shock absorbers.

Unit IV **Automotive Electrical System:** Battery construction, Charging and testing, battery types, Starting and Battery Charging System: Starter motor construction, types of drive, Alternator construction, regulation and rectification. Ignition System: Magneto and coil ignition systems, System components and requirements, automotive lighting: Wiring systems Electrical instruments; head lamp, electric horn, fuel level indicator.

Unit V **Automotive Air Conditioning:** Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis. Automotive Safety: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System)

Suggested Text / Reference Books:

1. Automobile Engineering, Sharma R.P., Dhanpat Rai & Sons.
2. Automobile Engineering, Gupta R.B., Satya Prakashan.
3. Vehicle and Engine Technology, Heniz Heisler, Elsvier Publication.
4. Automobile Engineering (Vol. 1 & 2), Kohli P.L., Tata McGraw Hill.
5. Automatic Transmission, Brejcha M.F., Prentice Hall India.

Course Outcomes:

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

CO1: Recognize the different parts of the automobile

CO2: Explain the working of various gears.

CO3: Describe how the steering and the suspension systems operate with wheels and tyres.

CO4: Understand the automotive electrical system

CO5: Develop a strong base for understanding automotive air conditioning

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	M	-	-	-	-	L	-	L	H	M
CO2	L2	H	M	M	M	M	-	-	-	-	L	-	L	M	H
CO3	L2	H	M	M	M	M	-	-	-	-	L	-	L	M	M
CO4	L2	L	L	L	L	L	-	-	-	-	L	-	L	H	M
CO5	L6	M	M	L	M	M	-	-	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEPEC801.B: Renewable Energy Engineering

Course Objectives:

- To acquire knowledge of technical competency combined with research to generate innovative solutions in Energy engineering.
- To be acquainted with a variety of options in energy sources.

Course Contents:

Unit I **Introduction:** Basic concepts of energy; Introduction to Renewable Energy Technologies; Energy and Environment – global warming, acid rains, depletion of ozone layer; Global and Indian Scenario of renewable energy sources; Energy storage - necessity and energy storage methods.

Unit II **Solar Energy:** Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data.
Solar Thermal Systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems.

Unit III **Wind Energy:** Introduction; Origin and nature of winds; Wind turbine siting; Basics of fluid mechanics; Wind turbine aerodynamics; wind turbine types and their construction; Wind energy conversion systems.

Unit IV **Fuel cells:** Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics. Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Unit V **Other forms of Energy:** Introduction: Nuclear, ocean and geothermal energy applications; Origin and their types; Working principles.

Suggested Text / Reference Books:

1. O.P. Gupta, “Energy Technology”, Khanna Book Publishing, New Delhi.
2. V.V.N. Kishore, “Renewable Energy Engineering and Technology: Principles and Practice,” Routledge, 1st Edition, 2019.
3. N. Jenkins and J. Ekanayake, “Renewable Energy Engineering,” Cambridge University Press, 1st Edition, 2017.
4. G. Boyle, “Renewable Energy,” OUP Oxford, 2nd Edition, 2009.

Course Outcomes:

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

CO1: Acquire, apply and share in depth knowledge in the area of Energy Engineering and Management.

CO2: An ability to apply engineering and scientific principles for the effective management of energy systems.

CO3: Able to understand the solar energy operation and its characteristics.

CO4: To educate the wind energy operation and its types

CO5: To educate the tidal and geothermal energy principles and its operation.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	M	-	-	-	-	L	-	L	H	M
CO2	L2	H	M	M	M	M	-	-	-	-	L	-	L	M	H
CO3	L2	H	M	M	M	M	-	-	-	-	L	-	L	M	M
CO4	L2	L	L	L	L	L	-	-	-	-	L	-	L	H	M
CO5	L6	M	M	L	M	M	-	-	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEPEC801.B: Product Innovation & Entrepreneurship

Course Objectives:

- To expose aspiring student entrepreneurs to various elements of a technology venture starting from market need identification to innovative solution development
- To be acquainted with innovative solution development and its commercialization through business planning and start-up company incubation.

Course Contents:

Unit I **Entrepreneurship:** Role of entrepreneurship in economic development; Entrepreneurial mindset, motivation and competencies; Market pull and technology push factors; New product development lifecycle; Technology readiness levels; Product-market fit validation; Commercialization pathways; Business vision & leadership; Team composition & management.

Unit II **Product Innovation:** Opportunity scanning, market survey, need identification and problem definition; Creative design thinking for concept generation; Detailed design & prototyping; Functionality & manufacturability; Bill of materials & components supply chain; Manufacturing & assembly plan; Product testing & quality assurance; Intellectual property rights management.

Unit III **Marketing & Finance:** Market segmentation & market sizing; Customer persona & value proposition; Marketing (Go-to-market) strategy; Distribution channels and sales network; Funding requirement (based on stage); Source of funding for startup ventures; Financial projections and accounting; Startup to scale up financing.

Unit IV **Venture Creation:** Sustainable business options & pathways; Business model & business canvas; Startup team & business partners; Startup ecosystem and stakeholders; Technology business incubators & parks; Proposal pitching & agreements; Startup company incorporation; Social impact & responsibility.

Unit V **Course Project:** Need identification, innovative solution, business plan, go-to-market strategy.

Suggested Text / Reference Books:

1. Bill Aulet, “Technology Entrepreneurship”, 4th ed., Tata McGraw Hill, 2014.
2. Peter F. Drucker, “Innovation and Entrepreneurship”, 1st ed., Harper Business, 2006.
3. Chelat Bhuvanachandran, Innovision, Khanna Book Publishing, 2022.
4. Byers, Dorf, and Nelson, Technology Ventures: From Ideas to Enterprise, McGraw Hill, 2010 Steve Blank, “The Startup Owner's Manual”
6. T.V. Rao, “Entrepreneurship - A South Asian Perspective”

Course Outcomes:

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

CO1: Understand how to identify an unmet need through market research

CO2: Learn how to create an innovative solution and check problem-solution fit

CO3: Practice business planning, including marketing, fund-raising and start-up incubation.

CO4: To plan, organize, and execute a project or new venture with the goal of bringing new products and service to the market

CO5: To carry out scientific research in the field of entrepreneurship

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	M	M	-	-	-	-	L	-	L	H	M
CO2	L2	M	M	M	M	M	-	-	-	-	L	-	L	M	H
CO3	L2	M	M	M	M	M	-	-	-	-	L	-	L	M	M
CO4	L2	L	M	L	L	L	-	-	-	-	L	-	L	H	M
CO5	L6	M	M	L	M	M	-	-	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEOEC802.B: Energy Management

Course Objective:

- To identify the energy management skills and strategies in the energy management system.
- To understand various energy conservation methods useful in a particular industry.
- To prepare an energy audit report.

Course Contents:

Unit-I **Introduction:** Energy resources, Energy conversion processes and devices – Energy conversion plants – Conventional - Thermal, Hydro, Nuclear fission , and Non – conventional – Solar, Wind Biomass, Fuel cells, Magneto Hydrodynamics and Nuclear fusion

Unit-II Energy Demand Management, Conservation &Resource Development, Energy for Sustainable Development.

Unit-III Need for Energy Management by Sector- Industry, Buildings & Houses, Transport, Electric Power.

Unit-IV Need for Energy Management by Sector- Agriculture, Domestic; Energy forecasting techniques; Energy Integration, Energy Matrix.

Unit-V Energy Auditing; Energy management for cleaner production, application of renewable energy, appropriate technologies.

Suggested Text / Reference Books:

1. Amlan Chakrabarti, Energy Engineering and Management, Prentice Hall India, 2011.
2. Eastop T. D. and D. R. Croft, Energy Efficiency for Engineers & Technologists, Longman, 1990.
3. Albert Thumann P. E. and W. J. Younger, Handbook of Energy Audits, Fairmont Press, 2008.
4. Doty S. and W. C. Turner, Energy Management Hand book, 7/e, Fairmont Press, 2009.
5. Rao S. and B. B. Parulekar, Energy Technology, Khanna Publishers, 2005.
6. Rai G. D., Non-conventional Energy Sources, Khanna Publishers, 2011.

Course Outcome:

After completing this course, the student will be able to:

CO1: Identify the scope and outcome of energy management.

CO2: Understand energy demand management and conservation of energy.

CO3: Understand need of energy management in industry, transport and buildings.

CO4: Know about energy forecasting techniques and energy integration and matrix.

CO5: Evaluate the techno economic feasibility of the energy conservation technique adopted.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	H	-	-	-	-	L	-	L	M	M
CO2	L2	H	M	H	M	M	-	-	-	-	L	-	L	H	M
CO3	L2	H	H	H	H	M	-	-	-	-	L	-	L	M	L
CO4	L1	H	H	H	H	M	-	-	-	-	L	-	L	M	M
CO5	L4	H	M	H	M	M	-	-	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEOE802.C: Waste and By-product Utilization

Objectives:

- To understand the type of waste and by products, waste identification, classification and composition.
- To know the need for waste treatment and utilization

Course Contents:

Unit-I **Introduction:** Types and formation of byproducts and waste; magnitude of waste generation in different agro- processing industries; concept scope and maintenance of waste management and effluent treatment,

Unit-II Waste Recycling & Resources Recovery System (WRRRS),Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues.

Unit-III Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, production of charcoal briquette, and generation of electricity using surplus biomass, producer gas generation and utilization.

Unit-IV Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermi-composting, Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological and chemical oxygen demand for different food plant waste– trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons.

Unit-V **Tertiary treatments:** Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste.

Suggested Text / Reference Books:

1. Waste and By-product Utilization By Dr. S. K. Singh
2. Food Processing By-Products and their Utilization, First by Anil K Anal
3. Utilization of Waste from Tropical Fruits by H.K. Sharma and Mandeep Kaur
4. Utilization of By-Products and Treatment of Waste in the Food Industry by Oreopoulou, Vasso, Russ, Winfried.

Course Outcomes:

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

CO1:.Identify various waste from food industries and understand their characteristics

CO2: Understand various methods of waste treatment .

CO3: Understand various by products from food industry waste

CO4: Apply knowledge for a functional ETP plant to suit requirement.

CO5: Understand aspects related to food waste disposal.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	M	-	M	-	-	M	-	M	M	M
CO2	L2	H	M	M	M	M	-	M	-	-	M	-	M	M	M
CO3	L2	H	M	M	M	M	-	M	-	-	M	-	M	L	L
CO4	L3	H	M	M	M	M	-	M	-	-	M	-	M	L	L
CO5	L2	H	M	M	M	M	-	M	-	-	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEOE802.D: MEDIUM AND SMALL ENTERPRISES MANAGEMENT

Objectives:

- To understand the type of small and medium enterprises
- To know the need small and medium enterprises

Course Contents:

Unit-I: **Small and Medium Enterprises:** Significance in Indian economy - Problems and the steps taken up by the Government to tackle their problems - Role of government in promoting small and medium enterprises - incentives provided to backward area and development.

Unit-II: **Project Formulation:** Project identification and formulation, Feasibility study - Project report preparation, location of Units, Industrial estates and the role of KIABD, TEKSOC and registration with DIC.

Unit-III: **Management Functions in Small and Medium Enterprises** –Finance function: Capital Estimation, Sources of finance - Subsides and Incentives, Venture Capital - Marketing and Human Resource Management functions.

Unit-IV: **Sickness in Small and Medium enterprises** - Causes of sickness, Prevention of sickness, and Remedial measures for sickness.

Unit-V: Ancillary Industries, Rural Industries and Artisans. Role of SIDO, SSIDC, SISI, DIC. Prospects for small-scale industries.

References:

1. C.S.V. Murthy, Small Scale Industries and Entrepreneurial Development, Himalaya Publishing House.
2. Vasant Desai, Management of SSI, Himalaya publishing House, Delhi,1998.
3. Vasant Desai, Small Scale Industries & entrepreneurship, Himalayan Publishing House.
4. S S Khanka, Entrepreneurial Development, Sultan Chand & Co. Ltd., New Delhi. 1999.

Course Outcomes:

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

CO1:.Identify various Small and Medium Enterprises

CO2: Understand various Project Formulation

CO3: Understand various Management Functions in Small and Medium Enterprises

CO4: Apply knowledge for identification of Sickness in Small and Medium enterprises.

CO5: Understand aspects related prospects for small-scale industries

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	M	M	M	-	-	M	-	-	M	-	M	M	M
CO2	L2	-	M	M	M	-	-	M	-	-	M	-	M	M	M
CO3	L2	-	M	M	M	-	-	M	-	-	M	-	M	L	L
CO4	L3	-	M	M	M	-	-	M	-	-	M	-	M	L	L
CO5	L2	-	M	M	M	-	-	M	-	-	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEPCC803: FEA Lab

Course Objectives:

- To understand the importance of automation for problem solving
- To get the knowledge of various finite elements methods based on software's

Lab Content:

1. Laboratory work for the solution of solid mechanics problems, heat transfer problems, and free vibration problems A: by using FE packages such as NASTRAN/ANSYS/SIMULIA/ABAQUS
2. Introduction of GUI of the software in the above mentioned areas' realistic problems.
3. Analysis of beams and frames (bending and torsion problems)
4. Plane stress and plane strain analysis problems
5. Problems leading to analysis of ax symmetric solids
6. Problems leading to analysis of three dimensional solids (a) Heat transfer problems
   (b) Modal analysis problem B: by writing own code for finite element analysis using MATLAB for:
7. Plane stress and plane strain analysis problems 8 Modal Analysis problem.

Course Outcomes:

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

CO1: Demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-purpose software

CO2: Examine model multi-dimensional heat transfer problems using ANSYS;

CO3: Demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes.

CO4: Understand the limitations of the FE method and understand the possible error sources in its use.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	L	-	-	-	-	M	-	L	M	M
CO2	L4	H	M	M	M	M	-	-	-	-	M	-	L	M	M
CO3	L3	H	M	M	M	M	-	-	-	-	M	-	L	M	M
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	----

BTMEPCC804: Automobile Engineering Lab

Course Objectives:

- To understand the importance of automation for problem solving
- To get the knowledge of various finite elements methods based on software's

List of Experiments:

1. Comparative study of four stroke diesel and petrol engines.
2. Comparative study of two stroke petrol and diesel engines
3. Trouble shooting in cooling system of an automotive vehicle
4. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap
5. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
6. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.
7. Fault diagnosis in transmission system including clutches, gear box assembly and differential.
8. Replacing of ring and studying the method of replacing piston after repair.
9. Valve re-facing and valve seat grinding and checking for leakage of valves

Course Outcomes:

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

CO1: Understand the Construction, working and other details about Internal Combustion Engines used in automobiles

CO2: Identify Construction, working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems.

CO3: Understand importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc.

CO4: Identify Modern technology and safety measures used in Automotive Vehicles

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	M	M	M	M	L	-	-	-	-	M	-	L	M	M
CO2	L4	M	M	M	M	M	-	-	-	-	M	-	L	M	M
CO3	L3	M	M	M	M	M	-	-	-	-	M	-	L	M	M
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	----

BTMEPROJ805: Engineering Project - III

Course Objective:

- To introduce the concept and methods required for the construction of large software intensive system.
- Todevelopabroadunderstandingofthedisciplineofsoftwareengineeringandmanagementofsoftwaresystem.
- To provide an understanding of both theoretical and methodological issues involve inmodernsoftwareengineeringprojectmanagementandfocusstronglyonpracticaltechniques

Course Outcomes:

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

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.

CO3: Identify, formulate and model problems and find engineering solution based on a systems approach.

CO4: Capability and enthusiasm for self-improvement through continuous professional development and life-long learning

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO2	L3	M	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO4	L4	M	M	H	L	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTMESODECA806: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

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

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

11. TEACHING-LEARNING PROCESS / METHODOLOGY (TLM):

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of technical program in a canonical manner. In this context, applications of technical program and linkage with the theory constitute a vital aspect of the teaching-learning process. The course offers many modes of learning and assessment methods. Students have great freedom of choice of course which they can study. The various components of teaching learning process are summarized in the following heads.

1. **Class room Lectures:** The most common method of imparting knowledge is through lectures. There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.
2. **Tutorials:** To reinforce learning, to monitor progress, and to provide a regular pattern of study, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.
3. **Practical:** To provide scientific visualization and obtaining results of Technical program impractical sessions. These sessions provide vital insights into scientific concepts and draw learner's attention towards limitations of scientific computations. During practical, scientific models arising in real life problems can also be simulated.
4. **Choice based learning/Open elective:** LOCF in this undergraduate program provides great flexibility both in terms of variety of courses and range of references in each course.
5. **Field based learning:** Students may enhance their knowledge through field based learning while understanding the practical importance.
6. **Textbooks learning:** A large number of books are included in the list of references of each course for enrichment and enhancement of knowledge.
7. **E-learning:** Learner may also access electronic resources and educational websites for better understanding and updating the concepts.
8. **Self-study materials:** Self-study material provided by the teachers is an integral part of learning. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.
9. **Assignment/Problem solving:** Assignments at regular intervals involving applications of theory are necessary to assimilate basic concepts of courses. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.
10. **Internships:** The teaching-learning process needs to be further supported by other activities devoted to subject-specific and interdisciplinary skills, summer and winter internships. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.
11. **Institute visits:** Institute visit by a learner is also a part of learning process. During such visits a learner has access to knowledge by attending academic

activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.

12. **Industrial visits:** Industrial visits offer an opportunity to observe applications of scientific concepts. These visits also give an opportunity to realize the power of mathematical ideas and their translation in problem solving.
13. **Training programs:** Training programs organized by various agencies/institutes provide an opportunity to learn various dimensions of courses.

12. ASSESSMENT AND OUTCOME MESUAREMENT METHODS (AOMM):

A range of assessment methods which are appropriate to test the understanding of various concepts of courses will be used. Various learning outcomes will be assessed using time-bound examinations, problem solving, assignments and viva-voce examination. For various courses in this program, the following assessment methods shall be adopted:

i Scheduled/unscheduled tests
ii. Problem solving sessions aligned with classroom lectures
iii. Practical assignments
iv. Regular chamber consultation with faculty members
v. Mid semester examination and semester end comprehensive examination

Examination and Evaluation:

I. The medium of instructions and examination shall be Bilingual.
II. Candidates shall be examined according to the scheme of examination and syllabus as approved by the BOS and Academic Council from time to time.
III. To pass each semester examination, a candidate must obtain at least 40% marks in each written paper, practical work semester examination.
IV. Each theory paper for the respective semester examination shall be set and evaluation of the answer books shall be done as per the University rules.
V. The assessment of External Evaluation i.e. End Term Semester Examination will be made out of 70 (Seventy) marks in theory Papers and Internal Evaluation of 30 (Thirty) marks.

Criterion for awarding Grading System:

Criterion for Awarding SGPA and CGPA: The criterion for awarding the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) for B.Tech. Program shall be as follows:

a) The criterion for passing in a subject is that a student should secure minimum 40% marks in individual paper.
b) A student obtaining less than pass marks as specified above, in each subject (sum of internal and End-Term examinations) he will be declared fail in that subject and will have to re-appear in a End-Term examination of the course in subsequent odd / even semester end term examination, subject to maximum permissible period of n+4 semesters to complete the course.

c) The University has adopted Absolute Grading System for converting marks into grades. The formula of 10- point grading system for conversion of marks obtained into Letter Grades and converting Letter Grades to Grade Point is given below:

d) Table: Marks, Letter Grades and Grade Points

Marks	Letter Grade	Grade Points
91-100	O (Outstanding)	10
81-90	A+(Excellent)	9
71-80	A(Very Good)	8
61-70	B+(Good)	7
51-60	B(Above Average)	6
46-50	C(Average)	5
40-45	P (Pass)*	4
0-39	F(Fail)	0
-	AB (Absent)	0

***Pass Mark: 40% in individual paper**

d) While converting the marks into Letter Grade, the rounding off marks must be considered.

e) A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

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

Computation of SGPA and CGPA:

The university has adopted UGC recommended procedure for computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

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

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

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course. The university shall issue Semester Grade Card to the student.

b) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

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

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

c) The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration of Computation of SGPA and CGPA and Format for Transcripts:

a) Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point
				(Credit x Grade)
Course/Paper 1	3	A	8	3x8=24
Course/Paper 2	4	B+	7	4x7=28
Course/Paper 3	3	B	6	3x6=18
Course/Paper 4	3	O	10	3x10=30
Course/Paper 5	3	C	5	3x5=15
Course/Paper 6	4	B	6	4x6=24
	20			**139**

Thus, SGPA= 139/20= 6.95

b) Illustration for CGPA

Semester-1	Semester-2	Semester-3	Semester-4	Semester-5	Semester-6	Semester-7	Semester-8
Credit: 20	Credit: 22	Credit: 25	Credit: 26	Credit: 26	Credit: 25	Credit: 24	Credit: 26
SGPA:6.9	SGPA:7.8	SGPA:5.6	SGPA:6.0	SGPA:6.3	SGPA:8.0	SGPA:8.0	SGPA:8.0

Thus, CGPA= 20x6.9+22x7.8+25x5.6+26x6.0+26x6.3+25x8.0+24x8.0+26x8.0

---------- = **7.06**

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13. TEACHERS TRAINING (TT):

Learning Outcomes Based Curriculum Framework (LOCF) Quality initiative of UGC based on Outcome Based Education (OBE) is being implemented by the University Grants Commission to enhance the Quality of Higher Education and that of Higher Education Learners and Teachers. Therefore, university arrange following activities for teachers training:

1. Workshops for LOCF implementation.
2. Seminar for LOCF implementation.
3. FDP on LOCF.
4. Outcome based higher education and understanding the learning objectives, learning outcomes, new approaches in the area of outcome measurement, preparing future ready teachers and students.
5. Developing a battery of quality speakers/educators to become resource persons to play role for Training of Trainers (TO

14. KEY WORDS:

LOCF, CBCS, Course Learning Outcomes, Employability, Graduate Attributes Communication Skills, Critical Thinking, and Descriptors.

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