Faculty of Engineering & Technology

Syllabus

For

Bachelor of Technology (B. Tech.)

in

Mechanical Engineering (ME)

(Program Code: ET0141)

(2022-26)

*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.

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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 ofTechnology 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 knowledgeof 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 analyzethe results and apply them in various problemsappearing 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 doin-depth study of variousproblems 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 branchesof 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 anentrepreneur 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 themain discipline/subject of study are referred to as Discipline Centric/Specific.

   > *Generic/Open Elective (GE):* An elective course chosen from an unrelateddiscipline/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.

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2. List of Course

a) Core Course:-

- Engineering Mathematics-I
- Engineering Physics
- EngineeringPhysics Lab
- Engineering Mathematics-II
- Engineering Chemistry
- Engineering Chemistry Lab
- Engineering Mathematics-III
- Engineering Mechanics
- Engineering Thermodynamics
- Materials Science and Engineering
- Mechanics of Solids
- Machine drawing practice
- Materials Testing Lab
- Basic Mechanical Engineering Lab
- Programming using MATLAB
- OOPS Lab
- Probability and Sampling Theory
- Digital Electronics
- 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
- Python Lab
- Measurement & Metrology
- Computer Integrated Manufacturing Systems
- Mechanical Vibrations
- Design of Machine Elements II

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- Non Conventional Machining Methods
- CIMS Lab
- Vibration Lab
- Machine Design Practice II Lab
- Thermal Engineering Lab
- Industrial Training/ Seminar
- Machine Learning Lab
- Research and publication ethics
- FEA Lab
- Thermal Engineering Lab-II
- Quality Control Lab
- Industrial Training
- Seminar
- Industrial Engineering Lab
- Metrology Lab
- Project

Elective Course:-

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

c) **Ability Enhancement Compulsory Courses (AECC):-**
- Communication Skills (Jeevan Kaushal-I)
- ANANDAM

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- HumanValues
- Environment Studies
- HumanValues Activities
- Object Oriented Programming
- Technical Communications
- Leadership & Management Skills

Skill Enhancement Courses (SEC):-

- Programming forProblemSolving
- Language Lab
- Computer Programming Lab
- Computer Aided Engineering   Graphics
- BasicMechanicalEngineering
- ManufacturingPracticesWorkshop
- ComputerAidedMachineDrawing

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

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9. PROGRAM STRUCTURE B. Tech. (ME)

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	Core	30	70	100	3	1	-	4
BTBSC102	EngineeringPhysics	Core	30	70	100	3	1	-	4
BTHSMC103	CommunicationSkills (Jeevan Kaushal-I)	AECC	30	70	100	2	-	-	2
BTESC104	Programming forProblemSolving	SEC	30	70	100	3	-	-	3
BTESC 105	BasicCivilEngineering	Elective	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC106	EngineeringPhysics Lab	Core	30	20	50	-	-	1	1
BTHSMC107	LanguageLab	SEC	30	20	50	-	-	1	1
BTESC108	ComputerProgrammingLab	SEC	30	20	50	-	-	1	1
BTESC 109	BasicCivilEngineeringLab	Elective	30	20	50	-	-	1	1
BTESC110	ComputerAided EngineeringGraphics	SEC	30	20	50	-	-	1	1
BTSODECA11	Social Outreach, Discipline &ExtraCurricular Activities		**50**	**-**	50	**-**	**-**	**-**	1
BTBSC 112	ANANDAM	AECC	**50**	**50**	100	**1**		**1**	2
	Total		**400**	**500**	**900**	**14**	**2**	**6**	**23**

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Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	EngineeringMathematics-II	Core	30	70	100	3	1	-	4
BTBSC 202	EngineeringChemistry	Core	30	70	100	3	1	-	4
BTHSMC203	HumanValues	AECC	30	70	100	2	-	-	2
BTESC204	BasicMechanicalEngineering	SEC	30	70	100	2	-	-	2
BTESC205	Basic Electrical Engineering	Elective	30	70	100	2	-	-	2
BTHSMC206	Environment Studies	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 207	EngineeringChemistryLab	Core	30	20	50	-	-	1	1
BTHSMC208	HumanValues Activities	AECC	30	20	50	-	-	1	1
BTESC209	ManufacturingPracticesWorkshop	SEC	30	20	50	-	-	1	1
BTESC210	Basic Electrical Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC211	ComputerAidedMachineDrawing	SEC	30	20	50	-	-	1	1
BTSODECA212	Social Outreach, Discipline & ExtraCurricular Activities		-	50	50	-	-	-	1
BTBSC 213	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**380**	**620**	**1000**	**15**	**2**	**6**	**24**

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SEMESTER: III

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEBSC301	Engineering Mathematics-III	Core	30	70	100	3	-	-	3
BTMEPCC302	Fluid Mechanics & Fluid Machines	AECC	30	70	100	3	-	-	3
BTMEESC303	Engineering Mechanics	Core	30	70	100	3	1	-	4
BTMEPCC304	Engineering Thermodynamics	Core	30	70	100	3	-	-	3
BTMEPCC305	Materials Science and Engineering	Core	30	70	100	3	-	-	3
BTMEPCC306	Mechanics of Solids	Core	30	70	100	3	1	-	4
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC307	Machine drawing practice	Core	30	20	50	-	-	1	1
BTMEPCC308	Materials Testing Lab	Core	30	20	50	-	-	1	1
BTMEPCC309	Basic Mechanical Engineering Lab	Core	30	20	50	-	-	1	1
BTMEPCC310	Programming using MATLAB	Core	30	20	50	-	-	1	1
BTMEPSIT311	Industrial Training	Core	30	20	50	-	-	-	1
BTMEPCC312	Fluid Mechanics Lab	Core	30	20	50	-	-	1	1
BTMESODECA313	Social Outreach, Discipline & Extra Curricular Activates		50	-	50			-	1
BTBSC 314	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**460**	**590**	**1050**	**19**	**2**	**6**	**29**

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Semester-IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEBSC401	Probability and Sampling Theory	Core	30	70	100	3	-	-	3
BTMEHSMC402	Technical Communications	AECC	30	70	100	2	-	-	2
BTMEESC403	Digital Electronics	Core	30	70	100	3	1	-	4
BTMEPCC404	Renewable Energy Sources	Core	30	70	100	3	1	-	4
BTMEPCC405	Manufacturing Processes	Core	30	70	100	3	1	-	4
BTMEPCC406	Theory Of Machines	Core	30	70	100	3	1	-	4
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC407	Digital Electronics Lab	Core	30	20	50	-	-	1	1
BTMEPCC408	Renewable Energy Sources Lab	Core	30	20	50	-	-	1	1
BTMEPCC409	Production Practice Lab	Core	30	20	50	-	-	1	1
BTMEPCC410	Theory Of Machine Lab	Core	30	20	50	-	-	1	1
BTMESODECA411	Social Outreach, Discipline & Extra Curricular Activates		50	-	50	-	-	-	1
BTBSC 412	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**400**	**550**	**950**	18	**4**	**5**	28

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Semester-V

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEESC501	Mechatronics Systems	Core	30	70	100	3	-	-	3
BTMEPCC502	Heat Transfer	Core	30	70	100	3	-	-	3
BTMEPCC503	Manufacturing Technology	Core	30	70	100	3	-	-	3
BTMEPCC504	Design Of Machine Elements I	Core	30	70	100	3	-	-	3
BTMEPCC505	Principles Of Management	Core	30	70	100	3	-	-	3
BTMEPEC506.A	Steam Engineering	Elective	30	70	100	3	-	-	3
BTMEPEC506.B	Automobile Engineering	Elective	30	70	100	3	-	-	3
BTMEPEC506.C	Robotics	Elective	30	70	100	3	-	-	3
BTBSC 507	Professional Skills	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEESC508	Mechatronics Lab	Core	30	20	50	-	-	1	1
BTMEPCC509	Heat Transfer Lab	Core	30	20	50	-	-	1	1
BTMEPCC510	Production Engineering Lab	Core	30	20	50	-	-	1	1
BTMEPCC511	Machine Design Practice Lab	Core	30	20	50	-	-	1	1
BTMEPSIT512	Industrial Training/ Seminar	Core	30	20	50	-	-	1	1
BTMEPCC513	Python Lab	Core	30	20	50	-	-	1	1
BTMESODECA514	Social Outreach, Discipline & Extra Curricular Activates		50	-	50	-	-	-	1
BTBSC 515	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**490**	**660**	**1150**	**21**	**0**	**7**	**29**

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Semester - VI

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEESC601	Measurement & Metrology	Core	30	70	100	3	-	-	3
BTMEPCC602	Computer Integrated Manufacturing Systems	Core	30	70	100	3	-	-	3
BTMEPCC603	Mechanical Vibrations	Core	30	70	100	3	-	-	3
BTMEPCC604	Design of Machine Elements II	Core	30	70	100	3	-	-	3
BTMEPCC605	Non-Conventional Machining Methods	Core	30	70	100	3	-	-	3
BTMEPEC606.A	Refrigeration & Air Conditioning	Elective	30	70	100	3	-	-	3
BTMEPEC606.B	Machine Learning	Elective	30	70	100	3	-	-	3
BTMEPEC606.C	Micro electro and mechanical systems (MEMS) and Microsystems	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC607	CIMS Lab	Core	30	20	50	-	-	1	1
BTMEPCC608	Vibration Lab	Core	30	20	50	-	-	1	1
BTMEPCC609	Machine Design Practice II Lab	Core	30	20	50	-	-	1	1
BTMEPCC610	Thermal Engineering Lab	Core	30	20	50	-	-	1	1
BTMEPSIT611	Industrial Training/ Seminar	Core	30	20	50	-	-	1	1
BTMEPCC612	Machine Learning Lab	Core	30	20	50	-	-	1	1
BTMESODECA613	Social Outreach, Discipline & Extra Curricular Activates		50	-	50	-	-	-	1
BTBSC 614	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**460**	**590**	**1050**	**19**	**0**	**7**	**27**

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Semester - VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC701	I.C. Engines	Core	30	70	100	3	-	-	3
BTMEPCC702	RAC	Core	30	70	100	3	-	-	3
BTMEPCC703	Computer Added Design	Core	30	70	100	3	-	-	3
BTMEAOEC704.A	Power Generation Sources	Elective	30	70	100	3	-	-	3
BTMEOEC704.B	Environmental Engineering and Disaster Management	Elective	30	70	100	3	-	-	3
BTMEOEC704.C	Non-Destructive System	Elective	30	70	100	3	-	-	3
BTMEPCC705	Research and publication ethics	Core	30	70	100	3	-	-	3
BTBSC706	Leadership & Management Skills	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC707	I.C. Engines Lab	Core	30	20	50	-	-	1	1
BTMEAPCC708	RAC Lab	Core	30	20	50	-	-	1	1
BTMEAPCC709	FEA Lab	Core	30	20	50	-	-	1	1
BTMEPSIT710	Industrial Training	Core	60	40	100	-	-	2	2
BTMEPSIT711	Project I	Core	60	40	100	-	-	2	2
BTMESODECA712	Social Outreach, Discipline & Extra Curricular Activity		50	-	50	-	-	-	1
BTBSC 713	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**490**	**610**	**1100**	**19**	**0**	**8**	**28**

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Semester - VIII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPEC801.A	Hybrid and Electric Vehicles	Elective	30	70	100	3	-	-	3
BTMEPEC801.B	Supply and Operations Management	Elective	30	70	100	3	-	-	3
BTMEPEC801.C	Additive Manufacturing	Elective	30	70	100	3	-	-	3
BTMEOE802.A	Finite Elements Methods	Elective	30	70	100	3	-	-	3
BTMEOE802.B	Energy Management	Elective	30	70	100	3	-	-	3
BTMEOE802.C	Waste and By-product Utilization	Elective	30	70	100	3	-	-	3
BTMEOE802.D	Medium And Small Enterprises Management	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC803	Industrial Engineering Lab	Core	30	20	50	-	-	1	1
BTMEPCC804	Metrology Lab	Core	30	20	50	-	-	1	1
BTMEPRJ805	Project	Core	210	140	350	3	-	4	7
BTMEESODECA806	Social Outreach,		50	-	50	-	-	-	1

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	Discipline & Extra								
BTBSC 807	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**430**	**370**	**800**	**10**	**0**	**7**	**18**

Note:

- A student is required to obtain min. 40% marks in individual paper to pass.

- The total credit of B.Tech. (ME) Programme is 206. However, the minimum credit required for award of degree shall be 200.

- The credit relaxation will be applicable only on the elective course from different semester (i.e. the student can opt out only elective subject).

- Out of the total credits, 20% of the credits may be earned by the student through MOOCs (SWAYAM, NPTEL, Coursera etc.). However, the choice of online courses to be approved in advance by Dean/ HoD and Coordinator SWAYAM keeping in view the latest guidelines of the UGC/ respective regulatory body guidelines.

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	Core	30	70	100	3	1	-	4
BTBSC102	EngineeringPhysics	Core	30	70	100	3	1	-	4
BTHSMC103	CommunicationSkills	AECC	30	70	100	2	-	-	2
BTESC104	Programming forProblemSolving	SEC	30	70	100	2	-	-	2
BTESC 105	BasicCivilEngineering	Elective	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC106	EngineeringPhysics Lab	Core	30	20	50	-	-	1	1
BTHSMC107	LanguageLab	SEC	30	20	50	-	-	1	1
BTESC108	ComputerProgrammingLab	SEC	30	20	50	-	-	1	1
BTESC 109	BasicCivilEngineeringLab	Elective	30	20	50	-	-	1	1
BTESC110	ComputerAided EngineeringGraphics	SEC	30	20	50	-	-	1	1
BTSODECA11	Social Outreach, Discipline &ExtraCurricular Activities		-	**50**	50	**-**	**-**	**-**	1
BTBSC 112	ANANDAM	AECC	**50**	**50**	100	**1**		**1**	2
	Total		**350**	**550**	**900**	**13**	**2**	**6**	**22**

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BTBSC101:EngineeringMathematics-I (common for all)

CourseObjectives:
- Tofamiliarizetheprospectiveengineerswithtechniquesincalculus,multivariateanalysis anddifferential equations.
- To equipthe studentswithstandard conceptsandtoolsataanintermediate to advancedlevel
- TounderstandVector Calculus with three important theorems.

Course Content:

UnitI: Differential Calculus:
Partial derivatives, directional derivatives, total derivative, Jacobians and properties.Leibnitz's Rule of differentiation under integral sign. Maxima And Minima , saddle points; Method of Lagrange multipliers,

UnitII: Integral Calculus:
Improperintegrals(BetaandGammafunctions) , Applicationsofdefinite integralsto evaluatesurfaceareas andvolumes ofrevolutions. Double integrals(Cartesian), change of order ofintegration Change of variables (Cartesian to), areas and volumes by double integration, Triple integrals (Cartesian), Simple applications

UnitIII:Differential Equations:
First Order and First degree ordinary differential equations: Linear and Bernoulli's equations, Exact equations, Linear Differential Equations of Higher order with constant coefficients.

Unit IV: Differential equations with variable Coefficients:
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy- Euler equation; Power series solutions including Legendre differential equation and Bessel differential equations.

UnitV: Vector Calculus:
Scalarlineintegrals,vectorlineintegrals,scalarsurfaceintegrals, surfaceintegrals,Theoremsof Green,GaussandStokes.

Textbooks/References:
1. G.B.ThomasandR.L.Finney,CalculusandAnalyticgeometry,9thEdition,Pearson,Reprint,2002.
2. Erwinkreyszig,AdvancedEngineeringMathematics,9thEdition,JohnWiley&Sons,2006.F201
3. VeerarajanT.,EngineeringMathematicsforfirstyear,TataMcGraw-Hill,NewDelhi,2008.
4. RamanaB.V.,HigherEngineering Mathematics,TataMcGrawHillNewDelhi,11thReprint,2010.
5. N.P.BaliandManishGoyal,AtextbookofEngineeringMathematics,LaxmiPublications,Reprint, 2008.

6. B.S.Grewal,HigherEngineeringMathematics,KhannaPublishers,36Edition,2010.

CourseOutcomes:

Atthe endofthecourse,thestudentwill beable to:

CO1: apply the Concepts of the differential calculus.
CO2: understandthe calculationandApplicationsofMultivariableintegrals.
CO3: understand and apply the concept of differential equations with constant coefficients.
CO4: understand and apply the concept of differential equations with variable coefficients and power series.
CO5: understand and apply the concept of vector calculus.

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	PS O1	PS O2
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

Mapping between Objectives and Outcomes

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BTBSC102: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.

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

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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: DescribeMaterial 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

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BTHSMC103 Communication Skills (Jeevan Kaushal-I)

Course Objectives:

1. To identify common communication problems that may be holding learners back

2. To identify what their non-verbal messages are communicating to others

3. To understand role of communication in teaching-learning process

4. To learn to communicate through the digital media

5. To understand the importance of empathetic listening

Course Contents

Unit I– Listening

Techniques of effective listening, Listening and comprehension, Probing questions, Barriers to listening

Unit IISpeaking andNon-verbal communication

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

Meaning of non-verbal communication, Introduction to modes of non-verbal communication, Breaking the misbeliefs , Open and Closed Body language, Eye Contact and Facial Expression Hand Gestures, Do's and Don'ts, Learning from experts, Activities-Based Learning

Unit III Reading

Techniques of effective reading, Gathering ideas and information from a given text: Identify the main claim of the text, Identify the purpose of the text, Identify the context of the text, Identify the concepts mentioned, Evaluating these ideas and information: Identify the arguments employed in the text, Identify the theories employed or assumed in the text, Interpret the text: To understand what a text says, To understand what a text does, To understand what a text means.

Unit IV   Writing and different modes of writing

Clearly state the claims, Avoid ambiguity, vagueness, unwanted generalisations and oversimplification of issues, Provide background information, Effectively argue the claim, Provide evidence for the claims, Use examples to explain concepts, Follow convention, Be properly sequenced, Use proper signposting techniques, Be well structured: Well-knit logical sequence,

Narrative sequence, Category groupings, Different modes of Writing: E-mails, Proposal writing for Higher Studies, Recording the proceedings of meeting: Any other mode of writing relevant for learners

Unit V Digital Literacy and Effective use of Social Media

Role of Digital literacy in professional life: Trends and opportunities in using digital technology in workplace, Internet Basics, Introduction to MS Office tools: Paint, Office, Excel ,.PowerPoint

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,   Introduction to Digital Marketing

Text Books:

1. Sen Madhucchanda (2010), *An Introduction to Critical Thinking*, Pearson, Delhi
2. Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

Suggested Readings:
1. Public Speaking, Michael Osborn and Suzanne Osborn, Biztantra
2. Handbook of Practical Communication Skills-Chrissie Wrought, published by Jaico Publishing House.

Course Outcomes:

CO	Statement	Blooms Level
	After completion of this course, students will be able to:	
CO1	Adapt effective listening skills	L3
CO2	Learn and demonstrate effective speech.	L3
CO3	Learn and demonstrate effective reading skills	L3
CO4	Know and practice effective writing skills	L1,L3
CO5	Understand and recognize the importance of digital literacy and social media	L2

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2
CO1	L3	**M**	**H**	**L**	**-**	**-**	**-**	**-**	**M**	**-**	**M**	**-**	**-**
CO2	L3	**-**	**H**	**M**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**
CO3	L3	**-**	**H**	**M**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**
CO4	L1,L3	**-**	**H**	**M**	**M**	**M**	**-**	**-**	**-**	**-**	**M**	**-**	**L**
CO5	L2	**-**	**H**	**H**	**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	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.

Syllabus

UNIT I:Fundamentals of Computer:

Stored program architecture of computers, Storage device- Primarymemory, 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 ofnumbers in radix r with special cases of r=2, 8, 10 and 16 withconversion from radix r1 to r2, r's and (r-1)'s complement, Binaryaddition, Binary subtraction, Representation of alphabets.

UNIT IV:C Programming:
Problem specification, flow chart, data types, assignment statements,input output statements, developing simple C programs, Ifstatement, 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

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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

BTESC105 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.

Detailed 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. 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.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

BTBSC106: 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.

 To study the variation of magnetic field at the center of coil using tangent galvanometer.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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	-----------

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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.

Detailed 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: Understandthe skillsrequired 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	-

B. Tech. (ME)

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BTESC 108: Computer Programming Lab

</div>

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-outputstatement.
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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	-----------

BTESC109A:BasicElectricalEngineeringLab

CourseObjectives:
- Tounderstand trainingon differenttrades like Fitting, Carpentryand Casting
- Tolearn various jointsaremadeusingwoodandothermetal pieces.
- Todevelop machiningskills in students.

ListofExperiments
1. Basicsafetyprecautions.Introductionanduseofmeasuringinstruments–voltmeter,ammeter,multi-meter, oscilloscope.Real-life resistors,capacitorsandinductors.
2. Transformers: Observation of the no-load current waveform on anoscilloscope. Loading ofatransformer: measurementof primaryandsecondaryvoltages and currents, andpower.
3. Three-phase transformers: Star and Delta connections. Voltage and Currentrelationships(line-line voltage, phase-to-neutral voltage, lineand phasecurrents).Phase-shifts betweenthe primaryand secondaryside.
4. Demonstrationofcut-outsectionsofmachines:dcmachine(commutateorbrusharrangement), induction machine (squirrel cage rotor), synchronous(fieldwinging - slipringarrangement)and single-phaseinduction
5. TorqueSpeed Characteristicof separatelyexcited dcmotor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use ofdc-acconverterforspeedcontrolofaninductionmotorand(d)ComponentsofLTswitchgear.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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	

BTESC 109B: 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 linesusing 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	--------------------------------

B. Tech. (ME)

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BTESC110: Computer Aided Engineering Graphics
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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.

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

Projections of Point & Lines: Position of Point, Notation System, SystematicApproach for projections of points, front view & Top view of point, Position ofstraight 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 ofthe plane, Distance of a point from plane, Angle between two planes.

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

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

Overview of Computer Graphics : Covering theory of CAD software [such as: Themenu System, Toolbars (standard, Object Properties, Draw, Modify andDimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialogboxes and windows, Shortcut menus (Button Bars), Command Line (whereapplicable), The Status Bar, Different methods of zoom as used in CAD, Select anderase 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

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BTSODECA111: 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	PO 10	P0 11	PO 12	PS O1	PS O2
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

BTBSC 112: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

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Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	EngineeringMathematics-II	Core	30	70	100	3	1	-	4
BTBSC 202	EngineeringChemistry	Core	30	70	100	3	1	-	4
BTHSMC203	HumanValues	AECC	30	70	100	2	-	-	2
BTESC204	BasicMechanicalEngineering	SEC	30	70	100	2	-	-	2
BTESC205	Basic Electrical Engineering	Elective	30	70	100	2	-	-	2
BTHSMC206	Environment Studies	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 207	EngineeringChemistryLab	Core	30	20	50	-	-	1	1
BTHSMC208	HumanValues Activities	AECC	30	20	50	-	-	1	1
BTESC209	ManufacturingPracticesWorkshop	SEC	30	20	50	-	-	1	1
BTESC210	Basic Electrical Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC211	ComputerAidedMachineDrawing	SEC	30	20	50	-	-	1	1
BTSODECA212	Social Outreach, Discipline & ExtraCurricular Activities		-	50	50	-	-	-	1
BTBSC 213	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**380**	**620**	**1000**	**15**	**2**	**6**	**24**

B. Tech. (ME)

BTBSC201 :Engineering Mathematics-II(common for all)

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 the course is an introduction to partial differential equations.
- To understand the various numerical methods and techniques used to find solutions to differential equations and linear programming problems.

Course Content:

Unit I: **Partial Differential Equations** –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 II: **Linear Algebra:** Vectors and Matrices, Addition and Multiplication, Norms, Linear Independence, Linear Transformation, Bases, Dimensions, Inner Product, Rank, Inverse, Orthogonality, Matrix factorizations, Translation, Dilation, Rotation, Reflection in a point, line and plane.Matrix form of basic geometric transformations.

Unit III: **Linear Algebra:** Rank of matrix System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and Eigen vectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Unit IV: **Numerical Methods:**Finitedifferences,Relationbetweenoperators, Methods to solve algebraic and transcendental equations , numerical methods to solve ordinary differential equations, finite difference methods, Finite element method.

Unit V: **Linear Programming Problems:**Linear Programming Problems, Graphical Approach, simplex method, Assignment and Transportation problems

Textbooks/References:
1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

2. Erwin kreyszig, Advanced Engineering Mathematics, 9[th]Edit 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, 11[th]Reprint, 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.

Course Outcomes:

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

CO1: Determine the solutions to partial differential equations.

CO2: understand the concepts of vector space and linear transformations.

CO3: Understand and to solve the matrices, Rank of a matrix, Eigen values and Eigen vectors, System of linear equations.

CO4: Use various numerical methods and techniques to solve algebraic and differential equations.

CO5: understand and to solve linear programming problems.

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	PS O1	PS O2
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

BTBSC202 : 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

Detailed 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	PO1 0	PO1 1	PO1 2	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

B. Tech. (ME)

BTHSMC203 :Human Values

Course Objective:
- To Know the basic guidelines, content and Process for Value Education
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Detailed contents:

Unit I: Course Introduction - Need, Basic Guidelines, Content andProcess for Value Education

Understanding the need, basic guidelines, Self Exploration – itscontent and process; 'Natural Acceptance' and Experiential Validation,Continuous Happiness and Prosperity- Human Aspirations, Rightunderstanding, Relationship and Physical Facilities,UnderstandingHappiness and Prosperity correctly- A critical appraisal of the currentscenario.Method to fulfill the above human aspirations: understanding andliving in harmony at various levels

Unit II: Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' andthe material 'Body'Understanding the needs of Self ('I') and 'Body' - Sukh and SuvidhaUnderstanding the Body as an instrument of 'I',Understanding thecharacteristics and activities of 'I' and harmony in 'I' Understandingthe harmony of I with the Body: Sanyam and Swasthya; correctappraisal of Physical needs, meaning of Prosperity in detail, Programsto ensure Sanyam and Swasthya.

Unit III: Understanding Harmony in the Family and Society- Harmony inHuman-Human Relationship

Understanding harmony in the Family, Understanding values inhuman-human relationship; meaning of Nyaya and program for itsfulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect(Samman) , meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals ,Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family.

Unit IV: Understanding Harmony in the Nature and Existence – Whole existence as Coexistence

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

Unit V: Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values

Definitiveness of Ethical Human Conduct.Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management

models. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers. Case studies related to values in professional life and individual life.

Suggested Text / Reference Books
1. Gaur R.R., Sangal R. and. Bagaria, G.P: "A Foundation Course in Human Values Professional Ethics," Excel Books, 2010.
2. Sadri S & Sadri, J Business Excellence Through Ethics & Governance, 2ndedition, 2015.
3. Mathur, U C CorporateGovernance and business ethics,MacMillan India Ltd, 2009.
4. Baxi, C V: CorporateGovernance, Excel Books, 2009
5. Sadri S, Sinha A K and Bonnerjee, P: Business Ethics: concepts and cases, TMH, 1998.

Course Outcomes:
At the end of the course, the student will be able to:
CO1: understand and analyze Basic Guidelines, Content and Process for Value Education.
CO2:understand Harmony in the Human Being - Harmony in Myself.
CO3: UnderstandHarmony in the Family and Society- Harmony in Human-Human Relationship.
CO4: understand Harmony in the Nature and Existence – Whole existence as Coexistence.
CO5: Understand of Harmony on Professional Ethics. Natural acceptance of human values.

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	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	-	L	M	H	L	M	-	L	M	L
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	M

CO5	L2	L	-	-	-	-	M	M	H	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	CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	

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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

Unit I: Fundamentals:

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Introduction to mechanical engineering, concepts of thermalengineering, mechanical machine design, industrial engineering andmanufacturing technology.Steam Boilers classification and types of steam boilers and steamturbines.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 ICEngines, Working of IC Engines and its components.

Unit III: Refrigeration and Air Conditioning:

Introduction, classification and types of refrigeration systems andair-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 toForging, Rolling, Extrusion, Drawing. Metal Joining Processes:Introduction to various types of Welding, Gas Cutting, Brazing, andSoldering.

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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

BTESC205: 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.

Detailed contents

UNIT I:DC Circuits:

Electrical circuit elements (R, L and C), voltage and current sources,Kirchhoff current and voltage laws, Series-Parallel circuits, Nodevoltage 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 starand 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 ofa three-phase induction motor, Significance of torque-slipcharacteristic. Starting and speed control of induction motor, singlephaseinduction motor. Construction, working, torque-speedcharacteristic 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-DCconverter.

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	P01 1	PO1 2	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

BTHSMC206: Environmental Studies

Unit-1 Basics of Environment: Components and types of ecosystem, Structure and functions of ecosystem, Energy flow in ecosystem .Type and levels of Biodiversity, Values, Causes of extension, and Conservation methods of biodiversity.

Unit- 2 Pollution: Types of Pollutants, air pollution, harmful effects of air pollution, control of air pollution, water pollution, harmful effects of water pollution, control of water pollution, noise Pollution harmful effects of noise pollution, control of noise pollution, radioactive pollution, harmful effects of radioactive pollution, control of radioactive pollution.

Unit-3 Solid Waste Management: Classification of solid waste, Collection, transportation, treatment, and disposal methods of solid waste, economic recovery of solid waste.

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Unit-4 Renewable Energy Sources**:** Introduction, renewable sources of energy: solar energy, wind energy, energy from ocean, energy from biomass, geothermal energy and nuclear Energy.

Unit-5 Issues of Environment: Sustainable development**,** water conservation, environmental education, environmental acts. Types of disasters, their causes, impact and preventive measures.

Recommended Books:

1. A.K. De, Environmental Chemistry, Wiley Eastern Ltd.
2. D.K.Sinha, Towards Basics of Natural Disaster Reduction, Research co Book Center, Delhi.
3. M.N.Rao and H.V.N.Rao, Air Pollution, Tata McGraw-Hill, ISBN-13 978-0-07-451871-7, 2013.
4. Ranjeeta Soni, Environmental Studies and Disaster managementNew India Publication Agency (NIPA), New Delhi, ISBN: 978-93-91383-02-2, October 2021.
5. R.C.Gaur, Basic Environmental Engineering New Age International Publication.

Course Outcomes

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

CO1: To understand the basic concepts and components of ecosystem and environment. Ecosystem Links between environmental components and their role.

CO2: To understand the basic concepts of pollution and their sources and effects and to apply the control technologies related pollutions.

CO3: To understand the types of wastes and their generation sources and to also know disposal technologies of waste and reuse and recycle of the waste.

CO4: To know the concepts of renewable energy resources and their types and create the various applications of renewable resources and current potentials of energy resources.

CO5: To understand the concept of sustainable development and create the methods for water conservation and apply the disaster control technologies.

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

B. Tech. (ME)

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1,L2	L	-	L	H	-	-	M	H	H	-	-	M	-	L
CO2	L2,L3	H	H	H	H	H	H	H	M	H	M	M	H	H	H
CO3	L1,L2	H	H	H	M	H	H	M	M	H	L	M	M	H	H
CO4	L1,L6	L	L	H	L	H	H	H	L	M	L	H	H	M	H
CO5	L2,L3	L	H	H	L	M	H	H	M	L	H	H	H	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

BTBSC 207: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 $K_2Cr_2O_7$ solution by using diphenyl amine indicator
5. Determination of the strength of $CuSO_4$ solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na_2CO_3 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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

B. Tech. (ME)

BTHSM208: Human Values Activities

Course Objective:

- **To Understand the** basic guidelines, content and process for value education.
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Detailed contents

PS 1:

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your salient achievements and shortcomings in your life? Observe and analyze them.

PS 2:

Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmadeproblems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?

PS 3:

1. Observe that each of us has the faculty of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions). Explore the following:
    (i) What is Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others?
    (ii) What is 'naturally Acceptable' to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it?
2. Out of the three basic requirements for fulfillment of your aspirations – right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

PS 4:

List down all your important desires. Observe whether the desire is related to Self (I) the Body. If it appears to be related to both, visualize which part of it is related to Self (I) and which part is related to Body.

PS 5:

1.   a. Observe that any physical facility you use, follows the given sequence with time: Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable

   b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!

2. List down all your important activities. Observe whether the activity is of 'I' or of Body or with the participation of both or with the participation of both 'I' and Body.

3. Observe the activities within 'i'. Identify the object of your attention for different moments (over a period of sy 5 to 10 minutes) and draw a line diagram connecting these points. Try observe the link between any two nodes.

PS 6:

1.   Chalk out some programs towards ensuring your harmony with the body – in terms of nurturing, protection and right utilization of the body.

2.   Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

PS 7:

Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST';

   1a. Do I want to make myself happy?

   2a. Do I want to make the other happy?

   3a. Does the other want to make himself/herself happy?

   4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

   1b. Am I able to always make myself happy?

   2b. Am I able to always make the other happy?

   3b. Is the other able to always make himself/herself happy?

What is the answer?

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence.

PS 8:

1.   Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.

2.   Also, observe whether your feeling of respect is based on treating the other as you would treat yourself or on differentiations based on body, physical facilities or beliefs.

PS 9:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to values in a difficult situation.

PS 10:

List down some common units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each unit with other orders.

PS 11:

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

PS 12:

Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values. If so, how should one proceed in this direction from the present situation?

PS 13:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

PS 14:

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core massage of this course grasped by you. How has this affected you in terms of;

    a. Thought
    b. Behavior
    c. Work and
    d. Relization

What practical steps are you able to visualize for the transition of the society from its present state.

Project:

Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work i.e. social work at villages adopted by respective institute/ college.

Course Outcomes:

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

CO1: Analyze Basic Guidelines, Content and Process for Value Education.

CO2: Understanding Harmony in the Human Being - Harmony in Myself.

CO3: UnderstandHarmony in the Family and Society- Harmony in Human-Human Relationship. Recollect and narrate an incident in your life.

CO4: UnderstandHarmony in the Nature and Existence – Whole existence as Coexistence. Summarize the core massage of this course grasped by you.

CO5: List ac and Implicate the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values.

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	-	-	-	-	L	L	M	H	L	M	-	L	M	L
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	L
CO5	L1	-	-	-	-	L	M	M	H	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	CO1,CO2
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTESC 209: 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 andother 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.

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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	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	

BTESC210A :Basic Electrical Engineering Lab

Course Objectives:
- To understandtraining on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood andother 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, capacitorsand inductors.
2. Transformers: Observation of the no-load current waveform on anoscilloscope. Loading of a transformer: measurement of primary andsecondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Currentrelationships (line-line voltage, phase-to-neutral voltage, line and phasecurrents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate orbrusharrangement), 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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	

BTESC210B:BasicCivilEngineeringLab

Course Objective:
- ToIntroduceTheVariousActivitiesRegardingMeasurementAnd Leveling
- ToWaterSupplyProcedureAndVariousDischargeAndPressureMeasuringApparatuses

LISTOFEXPERIMENTS:
1. LinearMeasurementbyTape:
   a) RangingandFixingof SurveyStationalongstraight lineandacross obstacles.
   b) Layingperpendicularoffset alongthe surveyline
2. CompassSurvey: MeasurementofbearingoflinesusingSurveyor'sandPrismaticcompass
3. Levelling:UsingTilting/Dumpy/AutomaticLevel
   a) Todeterminethereduced levelsinclosed circuit.
   b) Tocarryout profilelevellingand plotlongitudinal and cross sections for road byHeight ofInstrumentand Rise& Fall Method.
4. TostudyandtakemeasurementsusingvariouselectronicsurveyinginstrumentslikeEDM,Total Stationetc.
5. TodeterminepH, hardnessand turbidityofthegivensampleofwater.
6. Tostudyvarious watersupplyFittings.
7. TodeterminethepH andtotalsolids ofthegivensampleofsewage.
8. Tostudyvarious SanitaryFittings.

CourseOutcomes:
Attheend ofthe course,thestudent willbe ableto:
CO1: Conduct surveyandcollect field data.
CO2: Reviewfield notesfrom surveydata.

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CO3: Interpretsurveydataand computeareasandvolumes.
CO4: DescribeTotal stationandmeasurement
CO5: Describevariouswaterfittings andfindout thevarious fluidsproperties

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	PO11	PO12	PSO1	PSO2
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 211: 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.

Syllabus

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

Conversion of pictorial views into orthographic views: (1 drawing sheet)Introduction to orthographic prdcojection, concept of first angle and third angleprojection, drawing of simple machine elements in first angle projection, missingview 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 orbroken section, revolved section, removed section, offset section, sectioningconventions-spokes, web rib, shaft, pipes, different types of holes, conventions ofsection lines for different metals and materials.

Fasteners and other mechanical components: (Free hand sketch) Temporaryand 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 knucklejoints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc.Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, andpin 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 CADsoftware such as: The menu System, Toolbars (Standard, Object Properties, Draw,Modify and Dimension), Drawing Area (Background, Crosshairs, CoordinateSystem), Dialog boxes and windows, Shortcut menus (Button Bars), CommandLine (Where applicable), The Status Bar, Different methods of zoom as used inCAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple andcompound Solids.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	L	M
CO2	L4	H	L	H	L	L	-	-	-	-	L	-	L	L	L
LCO3	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	-----

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BTSODECA212: 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	PO 10	P0 11	PO 12	PS O1	PS O2
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

BTBSC213: ANANDAM

Objectives:

➢ To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.

➢ To inculcate the habit of service in students across the University.

➢ A compulsory course of 2 credits per semester to be included in each program of University.

➢ Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

➢ Do at least one act of individual service each day
➢ Record this act of service in a dedicated Register / Personal Diary
➢ Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
➢ Undertake one group service project for 64 hours every semester (outside college hours)
➢ Upload the report on the group project on the Anandam platform
➢ Participate in a sharing and presentation on the group service in the discussion sessions held once in week
➢ There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

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Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEBSC301	Engineering Mathematics-III	Core	30	70	100	3	-	-	3
BTMEPCC302	Object Oriented Programming	AECC	30	70	100	3	-	-	3
BTMEESC303	Engineering Mechanics	Core	30	70	100	3	1	-	4
BTMEPCC304	Engineering Thermodynamics	Core	30	70	100	3	-	-	3
BTMEPCC305	Materials Science and Engineering	Core	30	70	100	3	-	-	3
BTMEPCC306	Mechanics of Solids	Core	30	70	100	3	1	-	4
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC307	Machine drawing practice	Core	30	20	50	-	-	1	1
BTMEPCC308	Materials Testing Lab	Core	30	20	50	-	-	1	1
BTMEPCC309	Basic Mechanical Engineering Lab	Core	30	20	50	-	-	1	1
BTMEPCC310	Programming using MATLAB	Core	30	20	50	-	-	1	1
BTMEPSIT311	Industrial Training	Core	30	20	50	-	-	-	1
BTMEPCC312	OOPS Lab	Core	30	20	50	-	-	1	1
BTMESODECA313	Social Outreach, Discipline & Extra Curricular Activates		50	-	50			-	1
BTBSC 314	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**460**	**590**	**1050**	**19**	**2**	**6**	**29**

BTMEBSC301 Engineering 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 .

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 – 1:** 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'sformulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Unit-V **Complex Analysis:** Complex Variable. Complex Function, Analytic Function, Harmonic functions, Milne Thomson method, Complex integration, Cauchy integral formula,Cauchy integral formula for derivatives, Taylor theorems and Laurent Theorems, Residues theorem.

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, 11[th]Reprint, 2010

4. N.P.BaliandManishGoyal,AtextbookofEngineeringMathematics,LaxmiPublications,Reprint,

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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 and to use the concepts of differentiation and integration of complex functions .

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	PS O1	PS O2
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

BTMEPCC 302 : Object Oriented Programming

Course Objective:

•   To Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.

•   To Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

•   To Demonstrate ability to implement one or more patterns involving realization of an abstract interface and utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.

•   To Learn syntax, features of, and how to utilize the Standard Template Library. Learn other features of the C++ language including templates, exceptions, forms of casting, conversions, covering all features of the language.

Syllabus

Unit-1

Introduction to different programming paradigm, characteristics ofOOP, Class, Object, data member, member function, structures in C++, different access specifies, defining member function inside and outside class, array of objects.

Unit-2

Concept of reference, dynamic memory allocation using new and delete operators, inline functions, function overloading, function with default arguments, constructors and destructors, friend function and classes, using this pointer.

Unit-3

Inheritance, types of inheritance, multiple inheritance, virtual base class, function overriding, abstract class and pure virtual function

Unit-4

Constant data member and member function, static data member and member function, polymorphism, operator overloading, dynamic binding and virtual function

Unit-5

Exception handling, Template, Stream class, File handling.

Textbooks/References:
- E. Balagurusamy, Object Oriented programming, Tata McGraw Hill.
- K R Venugopal, Rajkumar, T Ravishankar, Mastering C++, Tata McGraw Hill.
- C. Thomas Wu, An Introduction to OOP with Java, McGraw Hill.
- Timothy Wood, An Introduction to Object Oriented Programming, Addison Wesley.
- John R. Hubbard, Programming with C++, McGraw Hill International.

Course Outcomes:

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

CO1: Underline the features of C++ supporting object oriented programming.

CO2: Describe the relative merits of C++ as an object oriented programming language.

CO3: Use how to produce object-oriented software using C++.

CO4: Describe how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism.

CO5: Understand advanced features of C++ specifically stream I/O, templates and operator overloading.

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

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Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	M	H	M	H	-	-	-	L	M	L	L	L	L
CO2	L2	H	M	M	M	M	-	-	-	L	M	-	M	M	L
CO3	L3	H	M	L	M	M	-	-	-	L	M	L	L	M	L
CO4	L1	M	M	M	M	M	L	-	-	L	M	-	M	L	M
CO5	L2	H	M	H	H	L	L	-	-	L	M	-	L	M	L

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, CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO4, CO5

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

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;

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- To analyze distributed forces and internal loads.
- To analyze forces in various systems such as frames, machines, trusses, beams and cables

Syllabus

UNIT 1 Statics of particles and rigid bodies:
Fundamental laws of mechanics,Principle of transmissibility, System of forces, Resultant force, Resolutionof force, Moment and Couples, Varignon's theorem, Resolution of a forceinto a force and a couple, Free body diagram, Equilibrium, Conditions forequilibrium, Lami's theorem.

Plane trusses:
Types of structures, Trusses, Support Conditions, Typesof Loadings, Classification of trusses, Determinacy of trusses, Basicassumptions of truss analysis, Method of joints, Method of sections.Virtual work: Principle of Virtual Work, Active forces and active forcediagram, Stability of equilibrium.

UNIT 2 Centroid & Moment of inertia:
Location of centroid and center ofgravity, Moment of inertia, Parallel axis and perpendicular axis theorem,Radius of gyration, M.I of composite section, Polar moment of inertia, M.Iof solid bodies.

Lifting machines: Mechanical advantage,
Velocity Ratio, Efficiency ofmachine, Ideal machine, Ideal effort and ideal load, Reversibility ofmachine, Law of machine, Lifting machines; System of pulleys, Simplewheel and axle, Wheel and differential axle, Weston's differential pulleyblock, Worm and worm wheel, Single purchase winch crab, Doublepurchase winch crab, Screw jack, Differential screw jack.

UNIT 3 Friction: Types of Friction, Laws of friction, Angle of friction, Angle ofrepose, 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 oftensions in flat belt drive, Power transmission by belt drives, Advantageand disadvantages of V-Belt over Flat Belt.

UNIT 4 Kinematics:
Fundamentals of rectilinear motion and curvilinear motion,applications of general equations, Projectiles motion on plane and oninclined plane, Concept of Relative motion.

Dynamics:
Principles of dynamics, D'Alembert's principle, conservationof momentum and energy, Work and Energy and impulse momentummethods, central impact, oblique impact, system of variable mass.

UNIT 5 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 africtional 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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	-

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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.

Syllabus

UNIT 1 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 ofThermodynamics, Temperature scale, First law of thermodynamics,First law analysis of some elementary processes. Steady and unsteady flow energy equations.

UNIT 2 Second Law of Thermodynamics: Heat engine, Heat pump andrefrigerator, Second law of thermodynamics, Equivalence of theKelvin-Plank and Clausius statements. Reversible and IrreversibleProcesses, Carnot engine, Efficiency of a Carnot engine, Carnotprinciple, thermodynamic temperature scale, Clausis Inequality.

Entropy: Entropy, Calculation of Entropy change, Principle of entropyincrease. Temperature-Entropy diagram, Second law analysis of acontrol volume.

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

UNIT 3 Thermodynamic Properties of Fluids: Pure substance, Concept ofPhase, 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, enthalpyand specific heats of an ideal gas, equations of state, Dalton's law ofpartial pressures, Gibbs Dalton law, Thermodynamic properties of gasmixtures.

UNIT 4 Thermodynamic Relations: Thermodynamic variables, Independentand dependent variables, Maxwell's thermodynamic relations,Thermodynamic relations involving entropy, Thermodynamic relationsinvolving enthalpy and internal energy, Joule-Thomson coefficient,Clapeyron equation.

Power Cycles: Otto cycle, Diesel cycle, Dual cycle, Brayton cycle andEricsson cycle.

UNIT 5 Vapour power cycle: Rankine cycle, effect of operating conditions onits efficiency, properties of ideal working fluid in vapour power cycleReheat cycle, regenerative cycle, bleeding extraction cycle, feed waterheating 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

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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	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

B. Tech. (ME)

BTMEPCC305: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.

Syllabus

UNIT 1 Crystal structure – BCC, FCC and HCP, unit cell, crystallographicplanes and directions, miller indices. Crystal imperfections, point,line, surface and volume defects.

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

UNIT 2 Classification of Engineering Materials: Solidification of metals and ofsome 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 binarysystem having complete mutual solubility in liquid state and limitedsolubility in solid state, binary isomorphous alloy system, Hume-Rothery rule , binary system with limited solid solubility of terminalphase and in which solubility decreases with temperature and alsoalloy with a peritectic transformation, equilibrium diagram of a systemwhose components are subject to allotropic change.

Iron carbon equilibrium diagram, phase transformation in the ironcarbon diagram, eutectic, peritectic, eutectoid and peritectoidreactions and microstructures.

UNIT 3 Isothermal transformation diagrams –cooling curves superimposed onIsothermal Transformation diagram, critical cooling rate. (i) Formationof Austenite from Pearlite (ii) Transformation of Austenite into Pearlite.

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

UNIT 4 Non-Metallic Materials- Polymers – types of polymer, commodity andengineering 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 5 Mechanical Properties and Testing: Types of fracture, testing ofmaterials under tension, compression and shear loads – hardnesstests (Brinell, Vickers and Rockwell) Impact test Izod and charpy,fatigue and creep test.

Classification of steels and cast iron constitution and properties. BISstandards.Engineering Ceramics – Properties and applications of Al_2O_3, SiC,Si_3N_4, PSZ etc. Fiber and particulate

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reinforced composites and resinplastics.Introduction to Nano materials- Nano structured materials. Nanoclusters & Nano crystals.

Suggested Text / Reference Books:
1. An Introduction to Material Scince 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 materialsthe 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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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	CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO4, CO5

BTMEPCC306 : Mechanics of Solids

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

Syllabus

UNIT 1 Stress and Strain: Elementary definition of stress and strain, stressstrainrelationship, elastic, plastic and visco-elastic behavior ofcommon materials in tension and compression test, stress-straincurves, Hooke's law, Poisson's ratio, elastic constants and theirrelations for an isotropic hookean material, anisotropic andorthotropic materials.

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

UNIT 2 Members Subjected to Flexural Loads: Theory of simple bending,bending moment and shear force diagrams for different types ofstatic loading and support conditions on beams.bending stresses, section modulus and transverse shear stressdistribution in circular, hollow circular, I, Box, T, angle sections etc.Strain energy due to bending.

UNIT 3 Principal Planes, Stresses and Strains: Members subjected tocombined axial, bending and torsional loads, maximum normal andshear stresses, concept of equivalent bending and equivalent twistingmoments, Mohr's circle of stress and strain.

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

UNIT 4 Torsion: Torsional shear stress in solid, hollow and stepped circularshafts, angular deflection and power transmission capacity. Strainenergy due to torsional loads.

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

UNIT 5 Transverse Deflection of Beams: Relation between deflection,bending moment, shear force and load, transverse deflection ofbeams and shaft under static loading, area moment method, directintegration method.

Thin-walled Pressure Vessels: Stresses in cylindrical and sphericalvessels

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: Evaluate 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 circularshafts

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

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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	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

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BTMEPCC307 :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 skill in developing new products.

CO4: Improve their technical skills in understanding engineering drawings.

CO5: Comprehend the theory of projection.

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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	PO1 0	P01 1	PO1 2	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	------

BTMEPCC308 : 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 structuralexamination-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 todetermine its various mechanical properties undertensile/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 fatiguestrength of the material

10 To perform Bending test and to determine the Young's Modulus of Elasticity viadeflection 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 thevarious 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 thedifferent approaches to modify structure/microstructure in order to get desired properties

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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	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	

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BTMEPCC309 :Basic Mechanical Engineering Lab

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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 avariety of activities, including hands-on assembly and disassembly ofmachines, such as, bicycle, sewing machine, pumps, engines, air-conditioners,machine-tools, amongst others; observational study of complex systems via cutsections, visits, videos and computer simulations; design of simplemachines/systems including specifications formulation; visits to industries.

2 Note: Student will be required to submit written report indicating the learningachieved 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

<div style="text-align:center">

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

Mapping between CO and CD

</div>

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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	

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BTMEPCC310 : Programming using MATLAB

Course Objectives:
- To determine the software skills.
- To learn the programming aspect of matrix lab.

List of Exercise
1. Basic functions of MATLAB computer programming
2. Use of formulae and inbuilt functions
3. MATLAB scripts and functions (m-files)
4. Loops and nested loops
5. Array, vector and matrices
6. Plotting functions and vector plots
7. Solving differential equations using MATLAB
8. Reading and writing data, file handling
9. Using MATLAB toolboxes
10. MATLAB graphic functions

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

CO1: Understand the main features of the MATLAB development environment

CO2: Use the MATLAB GUI effectively

CO3: Design simple algorithms to solve problems

CO4: Describe simple programs in MATLAB to solve scientific and mathematical 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

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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	PO1 0	P01 1	PO1 2	PSO 1	PSO 2
CO1	L2	H	L	L	M	L	-	-	-	-	L	-	L	M	M
CO2	L3	H	L	L	M	L	-	-	-	-	L	-	M	H	L
CO3	L6	M	L	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	L	M	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
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	-----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	

BTMEPSIT 311: Industrial Training / Seminar

CourseObjectives:
- Toacquireandapplyfundamentalprinciplesofengineering.
- Toidentify,formulateandpresentmodelproblems.
- Tofindengineeringsolutionsbasedona 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

BTMEPCC 312 : Object Oriented Programming Lab

Course Objective:
- To Perform object oriented programming for develop solutions to problems, demonstrating usage of control structures, modularity, I/O and other standard language constructs.
- To Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

List of Experiments:
1 Understand the basics of C++ library, variables, and data input-output.
2 C++ program using with the concept of structures.
3 Implement class and object concepts and function overloading.
4 Write programs to understand dynamic memory allocation and array of objects.
5 Program to understand different types of constructors and destructor.
6. Implement friend function to access private data of a class and usage of thisPointer.
7. Write programs to understand the usage of constant data member and member function, static data member and member function in a class.
8. Implement different types of inheritance, function overriding and virtual function
9. Implement Operator overloading concepts.
10. Write programs to understand function template and class template.
11. Write programs to understand exception handling techniques.
12. Write programs to understand file handling techniques.

Course Outcomes:

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

CO1: Apply OOPs features to program design and implementation.

CO2: Create Classes according to the problem and implement programs in C++

CO3: Implement Object Oriented Programs using templates and exceptional handling concepts.

CO4: Perform console operations, applications and file handling.

CO5: Implement applications using C++.

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 Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	M	-	-	-	L	L	-	L	M	M
CO2	L6	M	M	H	M	L	-	-	-	M	L	-	L	M	M
CO3	L3	M	M	H	M	L	-	-	-	L	M	-	L	H	L
CO4	L3	H	H	H	H	-	-	-	-	M	M	-	L	M	M
CO5	L3	H	M	H	M	M	-	-	-	M	L	-	L	M	M

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, CO5
CD3	Seminars	CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO5

BTMESODECA 313: Social Outreach, Discipline & Extra Curricular Activities

CourseObjectives:
- To allowingstudents to explorestrengthsand talents outside ofacademics.
- Tohelpingstudents developstronger time-managementand organizationalskills.
- To giving students the opportunity to build friendships and participate in group activitiesoutsideof thetight circleof theregular classroom.
- Tohelpingtobuildconfidence andself-esteem

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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

BTBSC314: ANANDAM

Objectives:

➢ To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.

➢ To inculcate the habit of service in students across the University.

➢ A compulsory course of 2 credits per semester to be included in each program of University.

➢ Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

➢ Do at least one act of individual service each day
➢ Record this act of service in a dedicated Register / Personal Diary
➢ Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
➢ Undertake one group service project for 64 hours every semester (outside college hours)
➢ Upload the report on the group project on the Anandam platform
➢ Participate in a sharing and presentation on the group service in the discussion sessions held once in week
➢ There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

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Semester-IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEBSC401	Probability and Sampling Theory	Core	30	70	100	3	-	-	3
BTMEHSMC402	Technical Communications	AECC	30	70	100	2	-	-	2
BTMEESC403	Digital Electronics	Core	30	70	100	3	1	-	4
BTMEPCC404	Fluid Mechanics & Fluid Machines	Core	30	70	100	3	1	-	4
BTMEPCC405	Manufacturing Processes	Core	30	70	100	3	1	-	4
BTMEPCC406	Theory Of Machines	Core	30	70	100	3	1	-	4
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC407	**Digital Electronics**Lab	Core	30	20	50	-	-	1	1
BTMEPCC408	Fluid Mechanics Lab	Core	30	20	50	-	-	1	1
BTMEPCC409	Production Practice Lab	Core	30	20	50	-	-	1	1
BTMEPCC410	Theory Of Machine Lab	Core	30	20	50	-	-	1	1
BTMESODECA411	Social Outreach, Discipline & Extra Curricular Activates		50	-	50	-	-	-	1
BTBSC 412	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**400**	**550**	**950**	18	**4**	**5**	28

B. Tech. (ME)

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-1 : **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-2 STANDARD DISTRIBUTIONS Binomial, Poisson, Geometric, Uniform, Exponential, Weibull and Normal distributions and their properties.

Unit-3: **TWO DIMENSIONAL RANDOM VARIABLES:** Joint distributions - Marginal and conditional distributions – Covariance – Correlation and regression - Transformation of random variables - Central limit theorem

Unit-4 SAMPLINGTHEORY: 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-5 SAMPLINGTHEORY: 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 Queueing 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.

B. Tech. (ME)

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	PS O1	PS O2
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 : Technical Communication

Course Objectives: -
- To understand the characteristics of technical writing
- To understandcomplex engineering ideas for targeted audiences.
- To understand the advance technical writing in professional documents.
- To write effective technical and business documents that are grammatically and stylistically correct

Detailed Contents

UNIT1

Introduction to Technical Communication- Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.

UNIT 2

Comprehension of Technical Materials/Texts and Information Design & development- Reading of technical texts, Reading andcomprehending instructions and technical manuals, Interpreting andsummarizing technical texts, Note-making. Introduction of differentkinds of technical documents, Information collection, factors affectinginformation and document design, Strategies for organization,Information design and writing for print and online media.

UNIT 3

Technical Writing, Grammar and Editing- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.

UNIT4

Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals,

UNIT 5

 Advanced Technical Writing- Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.

Text/Reference Books:

1.   David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. NewYork, M004

2. M. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, M003. (ISBN 031M406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, M003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, M004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, M004. (ISBN: 078M8357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi M00M.
7. Xebec, Presentation Book, TMH New Delhi, M000. (ISBN 040MM13)

Course Outcomes:

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

CO1 Understand basic communication skills used in technical areas.

CO2 Understand technical materials, texts and information design & development.

CO3 Adapt an effective oral presentation, displaying the ability to engage the audience by employing a suitable delivery style, appropriate language and quality visual aids.

CO4 Interpret Technical Reports and its types& features

CO5 Understand thestructure and formats of technical articles and proposals

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 Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	L	L	-	-	L	M	L	H	M	L
CO2	L2	-	-	-	-	M	L	-	-	L	M	L	H	M	L
CO3	L3	-	-	-	-	L	L	-	-	L	M	L	H	L	M
CO4	L4	-	-	-	-	L	L	-	-	L	M	L	H	L	M
CO5	L2	-	-	-	-	M	L	-	-	L	M	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	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

<div align="center">

BTMEPCC403: Digital Electronics
</div>

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.

<div align="center">

Syllabus
</div>

Unit1Introduction: 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.

Unit2Operational 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.

Unit3Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

Unit4Digital 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.

Unit5 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

BTMEPCC404: FUNDAMENTALS OF RENEWABLE ENERGY SOURCES

Course Objectives:

- Student will get to know various of Renewable Energy Sources

- Practical exposure to analyze basic parameters energy & its generation techniques

Unit I: Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES: Solar, Wind, Geothermal, Biomass, Ocean energy sources. Comparison of renewable energy sources with non renewable sources.

Unit II : Solar Energy: Energy available from Sun, Solar radiation data, solar energy conversion into heat through: Flat plate and Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system, Solar Photo voltaic: p-n junctions. Solar cells, PV systems, standal one, Grid connected solar power station, Calculation of energy through photo voltaic power generation and cost economics.

Unit III: Wind Energy: Energy available from wind, Lift and drag forces. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Wind mill rotors, Determination of torque coefficient, Induction type generators, working principle of wind power plant.

Unit IV: Bio-energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of bio gas plants, bio gas generation, factors affecting biogas generation and usages; advantages and disadvantages of bio gas spent slurry.

SuggestedReadings

1.   Rai,G.D.2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.

2.   Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.

3.   Khandelwal, K.C .& S. S. Mahdi. 1990. Biogas Technology- A Practical Hand book.

4.   Rathore N.S. ,Kurchania A.K.,Panwar N.L. 2007. Non Conventional Energy Sources, Himanshu Publications.

5.   Tiwari,G.N.and Ghoshal ,M.K.2005. Renewable Energy Resources: Basic Principles and Applications .Narosa Pub. House. Delhi.

6.   Rathore N.S. ,Kurchania A.K.,Panwar N.L.2007. Renewable Energy, Theory and Practice, Himanshu Publications.

Course Outcomes:

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

CO1. Understanding of renewable energy sources

CO2. Knowledge of working principle of various energy systems

CO3. Capability to carry out basic design of renewable energy systems

CO4. Present utilization of renewable energy sources for both domestic and industrial applications

CO5- Operate and analyze the rural energy needs.

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 with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	H	M	L	-	L	-	L	M	-	L	M	L
CO2	L1	H	M	H	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	M	H	M	L	-	-	-	-	M	-	L	L	M
CO4	L2	H	H	H	H	L	-	L	-	-	H	-	L	M	L
CO5	L2	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

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

Syllabus

Unit 1 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;

centrifugalcasting,investment casting; Permanent mould casting. Die casting; Slush casting. Casting defects; types, causes and remedy

Unit 2 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 3 **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 4 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 5 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

B. Tech. (ME)

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

Syllabus

Unit 1 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 2 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 3 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 4 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 5 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

B. Tech. (ME)

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	-

BTMEPCC407 :Digital 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 gateswith 2, 3, & 4 inputs).

2 To verify the truth table of OR, AND, NOR, Ex-OR. Ex-NOR realized usingNAND & 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-8demultiplexerusing blocks of 4-to-1   multiplexer   and   1-to-4 demulriplexer.

7 Design & Realize a combinational circuit that will accept a 2421 BCD code anddrive 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 withoutclock signal and verify their truth table.

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

10 Perform   input/output   operations   on   parallelin/parallel   out andSerialin/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:

B. Tech. (ME)

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 ofdigital 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	

BTMEPCC408 : Renewable Energy Sources Lab

Course Objectives:
- To understand basic of energy sources
- To discuss the differences of renewable and non renewable sources

List of Exercise

Practical

1. Study of different types of solar cookers.
2. Study of Solar water heating system.
3. Study of Solar photovoltaic system.
4. Study of Natural convection solar dryer
5. Study of Forced convection solar dryer.
6. Study of Solar desalination unit.
7. Study of fixed dome biogas plants.
8. Study of floating drum biogas plants.
9. Study of biomass gasifiers.
10. Study of biomass improved cook- stoves.

Course Outcomes:

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

CO1: Identify, name and characterize renewable sources

CO2: Understand basic units heating units

CO3: Utilize basic measurement techniques of convection

CO4 Discuss the differences among energy plants

CO5: Utilize various renewable energy sources.

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	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	

BTMEPCC409 : 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 perdrawing.
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. Toprepare 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 pergiven drawing.
3 Demonstration on milling machine for generation of plane surfaces and use ofend 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:

B. Tech. (ME)

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

1To study inversions of four bar chain and slider crank mechanism and their practical applications.

2To study Steering Mechanisms: Davis and Ackerman.

3Study of quick return mechanism and its practical applications.

4Study of inversion of Double slider chain: Oldham Coupling, Scotch Yoke andElliptical Trammel.

5Study of various cam-follower arrangements. To plot displacement v/s angle of rotation curve for various cams

6To determine co-efficient of friction using two roller oscillating arrangement.

7Study of various types of dynamometers, Brakes and Clutches.

8Study of differential gear box.

9To verify the torque relation for gyroscope.

10To perform wheel balancing. To perform static and dynamic balancing on balancing set up.

11Study 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

CourseObjectives:

- To allowingstudents to explorestrengthsand talents outside ofacademics.
- Tohelpingstudents developstrongertime-management andorganizationalskills.
- Togivingstudentstheopportunitytobuildfriendships andparticipateingroupactivitiesoutsideof thetight circleof theregular classroom.
- Tohelpingtobuildconfidence andself-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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

BTBSC412: ANANDAM

Objectives:

➢ To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.

➢ To inculcate the habit of service in students across the University.

➢ A compulsory course of 2 credits per semester to be included in each program of University.

➢ Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

➢ Do at least one act of individual service each day
➢ Record this act of service in a dedicated Register / Personal Diary
➢ Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
➢ Undertake one group service project for 64 hours every semester (outside college hours)
➢ Upload the report on the group project on the Anandam platform
➢ Participate in a sharing and presentation on the group service in the discussion sessions held once in week
➢ There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

B. Tech. (ME)

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEESC501	Mechatronics Systems	Core	30	70	100	3	-	-	3
BTMEPCC502	Heat Transfer	Core	30	70	100	3	-	-	3
BTMEPCC503	Manufacturing Technology	Core	30	70	100	3	-	-	3
BTMEPCC504	Design Of Machine Elements I	Core	30	70	100	3	-	-	3
BTMEPCC505	Principles Of Management	Core	30	70	100	3	-	-	3
BTMEPEC506.A	Steam Engineering	Elective	30	70	100	3	-	-	3
BTMEPEC506.B	Automobile Engineering	Elective	30	70	100	3	-	-	3
BTMEPEC506.C	Robotics	Elective	30	70	100	3	-	-	3
BTBSC 507	Professional Skills	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEESC508	Mechatronics Lab	Core	30	20	50	-	-	1	1
BTMEPCC509	Heat Transfer Lab	Core	30	20	50	-	-	1	1
BTMEPCC51009	Production Engineering Lab	Core	30	20	50	-	-	1	1
BTMEPCC511	Machine Design Practice Lab	Core	30	20	50	-	-	1	1
BTMEPSIT512	Industrial Training/ Seminar	Core	30	20	50	-	-	1	1
BTMEPCC513	Python Lab	Core	30	20	50	-	-	1	1
BTMESODECA514	Social Outreach, Discipline & Extra Curricular Activates		50	-	50	-	-	-	1
BTBSC 515	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**490**	**660**	**1150**	**21**	**0**	**7**	**29**

B. Tech. (ME)

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

Syllabus

Unit 1. 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.

Unit2. Modeling, 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 3. 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 4. 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 5. 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: Identifythe 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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.
- Tostudy rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.

Syllabus

Unit1. 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 2. 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 3. 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 4. 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 5. 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

B. Tech. (ME)

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	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.

Syllabus

Unit1. 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 2. 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 3. 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 4. 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 5. 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.

B. Tech. (ME)

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

Syllabus

Unit 1 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 2 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 3 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 4 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 5 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.

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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	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	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 :Principles of Management

Course Objectives:
- To understand the principles of management and their application to the functioning of an Organization
- To provide them tools and techniques to be used in the performance of the managerial job.
- To enable them to analyze and understand the environment of the organization.

Syllabus

Unit 1 Introduction: Objective, scope and outcome of the course. Basic concepts of management: Definition – Need and Scope – Different schools of management thought – Behavioural, Scientific, Systems, and Contingency Contribution of Management Thinkers: Kautilya, Taylor, Fayol, Peter Drucker and C.K. Prahlad.

Unit 2 Functions of Management: Planning: Essentials of Planning and Managing by Objectives; Strategies, Policies and Planning Premises; Decision making.Organizing The Nature of organizing, Entrepreneuring, and Reengineering; Organizational Structure, Departmentation; Line/staff authority, empowerment, and decentralization; Effective organizing and organization culture;

Unit 3 Staffing Human resource Management and Selection; Performance Appraisal and Career Strategy; managing change through Manager and Organization Development.

Unit 4 Leading Human Factors and Motivation; Leadership: Committees, Terms, and Group Decision making; Communication. Controlling The system and process of controlling; Control Techniques and Information Technology; Productivity, Operations Management and Total Quality Management.

Unit 5 Management practices of: Dhirubhai Ambani, Narayan Murthy, Premji, Ratan Tata, Steve Jobs, Bill Gates. Studying organizational structures of any 10 companies and classifying them into different types of organizations which are studied above and justifying why such structures are chosen by those organizations. Preparing the leadership profiles of any 5 business leaders and studying their leadership qualities.

Suggested Text / Reference Books:
1. Works Organisation and Management, Basu S.K., Sahu K.C., Datta N.K., Oxford and IBH.
2. Principles of Industrial Organization, Dexter S. Kimball, Read Books.
3. Principles of Industrial Management, Alford and Beatty, Revised Edition, Ronald Press Co.
4. Essentials of Industrial Management, McGraw-Hill industrial organization and management series, Lawrence L. Bethel, McGraw-Hill.
5. Engineering Economics, Riggs, Tata McGraw-Hill

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Course Outcomes:

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

CO1: Understand the concepts related to Business.

CO2: Demonstrate the roles, skills and functions of management.

CO3: Analyze effective application of PPM knowledge to diagnose and solve organizational problems and develop optimal managerial decisions.

CO4: Understand the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities.

CO5: UnderstandManagement practices of world famous groups.

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	-	-	-	-	-	L	-	-	M	L	L	L	M	M
CO2	L3	-	-	-	-	-	M	-	-	M	L	L	L	H	M
CO3	L4	L	L	L	L	-	M	-	-	M	L	M	L	M	H
CO4	L2	-	-	L	-	-	M	-	-	M	L	M	L	M	M
CO5	L2	-	-	-	-	-	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,
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4,

BTMEPCC506.A: Steam Engineering

Course Objectives:

- To understand the construction of various parts of steam plants.
- To understand the working principle of various parts steam generation

Syllabus

Unit 1 Introduction: Objective, scope and outcome of the course. Steam generators: Classification of Boilers, water and fire tube boilers, High pressure boilers, Advantages of high pressure Boilers, Natural and forced circulation boilers, Water wall. Steam drum internal, steam super heaters, Economizers, air preheater, induced, forced and balanced draught boilers, Fluidized bed boilers

Unit 2 Definition and type of nozzle and diffuser equation of continuity, sonic velocity, mach no. and stagnation properties, the steady flow energy equation for nozzles, momentum energy equation for flow through steam nozzles nozzle efficiency, effect of friction, nozzle for uniform pressure drop, throat pressure for maximum discharge or chock flow, critical pressure ratio, design of nozzle and diffuser.

Unit 3 Steam Turbines: Principle and working of steam turbines, type of turbines, compounding for pressure and velocity. Overview and difference of various type of turbine, different types of governing of turbines. Impulse turbine: The effect of blade friction on velocity diagram. Force, work and power, Blade or diagram efficiency, Gross stage efficiency, steam speed to blade, speed ratio for optimum performance, turbine performance at various loads

Unit 4 Impulse reaction turbine: Velocity diagram and work done, degree of reaction, Parson turbine, blade efficiency, gross stage efficiency comparison of enthalpy drop in various stages, size of blades in impulse reaction turbines for various stages of impulse reaction and impulse turbine. Regenerative Feed Heating Cycles: Introduction, Ideal regenerative feed heating cycle, Regenerative heating cycles and their representation on T-s and h-s Diagram, Representation of actual process on T-s and h-s Diagram Regenerative cycles, types of feed heating arrangements, Optimum feed water temperature and saving in Heat Rate. direct contact and surface heaters.

Unit 5 Reheating of steam: Practical reheating and Non- reheating cycles, advantage and disadvantages of reheating, reheat regenerative cycle, regenerative water extraction cycles. Process heat and by product power cycle, pass out turbine, Binary vapour cycle. Condensers**.**

Suggested Text / Reference Books:

1. Steam Engineering , S K Jain , Bhariya Publication
2. Steam Engineering Gupta R.B., Satya Prakashan.

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Course Outcomes:

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

CO1: Determine the efficiency and output of a modern Rankine cycle steam power plant from given data, including superheat, reheat, regeneration, and irreversibility's

CO2: Calculate the heat rate, fan power consumption, flame temperature and combustion air requirements of conventional steam generators (boilers).

CO3: Select the heat transfer tubes needed for condensers and feed water heaters

CO4: Explain the blade shapes, and calculate work output of typical turbine stages.

CO5: Calculate the performance of gas turbines with reheat and regeneration, and discuss the performance of combined cycle power plants.

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	M	M	-	-	-	-	L	-	L	H	M
CO2	L2	H	M	M	M	M	-	-	-	-	L	-	L	M	H
CO3	L2	H	L	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

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BTMEPCC506.B: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

Syllabus

Unit 1 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 2 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 3 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 4 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 5 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:
3. Automobile Engineering, Sharma R.P., Dhanpat Rai & Sons.
4. Automobile Engineering, Gupta R.B., Satya Prakashan.
5. Vehicle and Engine Technology, Heniz Heisler, Elsvier Publication.
6. Automobile Engineering (Vol. 1 & 2), Kohli P.L., Tata McGraw Hill.
7. Automatic Transmission, Brejcha M.F., Prentice Hall India.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

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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	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTMEPCC506.C: Robotics

Course Objective

1. Toclassify the robots and robotic arm.

2. To know the application of various sensors.

3. To design and compute kinematics of robotics.

4. To make computer program used in robotics.

Syllabus

UNIT I

Fundamentals of Robots: Introduction, definition of robot, classification of robots, History of robotics, robot components, degree of freedom, robot joints, robot coordinates, reference frames, programming modes, robot characteristics, robot work space, robot languages, advantages, disadvantages and applications of robots.

UNIT 2

Dynamic analysis and forces: Introduction, Lagrangian mechanics, Effective moments of inertia, dynamic equations for multi-degree of freedom robots-kinetic energy, potential energy, the Lagrangian, robot's equations of motion, static force analysis of robots.

UNIT 3

Trajectory planning: Introduction, path Vs trajectory, basics of trajectory planning, joint space trajectory planning-third order polynomial trajectory planning, fifth order polynomial trajectory planning, Cartesian-space trajectories.

UNIT 4

Robot Actuators: Introduction, characteristic of Actuating systems-weight, power to weight ratio, operating pressure, stiffness Vs compliance,comparision of actuating systems, hydraulic devices, pneumatic devices, servomotors, stepped motors.

UNIT 5

Robot sensors: Introduction, sensor characteristics, LVDT, Velocity sensors-Encoders, Tachometers, Accelerating sensors, strain gauges, Torque sensors, light and infrared sensors, touch and tactile sensors, optical proximity sensors, Ultrasonic proximity sensors.

Reference books:

1. Introduction to Robotics – Analysis, System, Applications by Saeed B. Niku, PHI
Publications

2. Industrial Robotics – Mikell P. Groover & Mitchell Weiss, Roger N. Nagel,Nicholas

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G.Odrey – Mc Graw Hill, 1986

Course Outcome

After successful completion of Robotics course, the student will be able to

CO 1: Classify robots based on joints and arm configurations and Design application specific end effectors for robots.

CO 2:Understand the application of various sensors for direct contact and non-contact

Measurements and Understand many modern devices and technologies used in sensors.

CO 3: Compute forward and inverse kinematics of robots and determine trajectory plan apply the knowledge in Robot anatomy, end effectors, sensors, vision systems, and kinematics

CO 4: Program robot to perform typical tasks including Pick and Place, Stacking and Welding.

CO 5: Design and select robots for Industrial and Non-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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	M	M	L	M	-	-	-	-	L	-	L	H	M
CO2	L2	M	M	M	L	M	-	-	-	-	L	-	L	M	H
CO3	L2	M	M	M	M	M	-	-	-	-	L	-	L	M	M
CO4	L2	L	L	L	L	L	-	-	-	-	L	-	L	H	M
CO5	L2	M	M	L	L	M	-	-	-	-	L	-	L	M	L

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

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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	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTBSC507: Professional Skills

Objectives:
1. To acquire career skills and fully pursue to partake in a successful career path
2. To prepare good resume, prepare for interviews and group discussions
3. To explore desired career opportunities in the employment market in consideration of an individual SWOT.

Course

Unit I: Resume Skills & Interview Skills
Resume Skills : Preparation and Presentation, Introduction of resume and its importance, Difference between a CV, Resume and Bio data, Essential components of a good resume, Resume skills : common errors, Common errors people generally make in preparing their resume, Prepare a good resume of her/his considering all essential components

Interview Skills : Preparation and Presentation, Meaning and types of interview (F2F, telephonic, video, etc.), Dress Code, Background Research, Do's and Don'ts, Situation, Task, Approach and Response (STAR Approach) for facing an interview, Interview procedure (opening, listening skills, closure, etc.), Important questions generally asked in a job interview (open and closed ended questions), Interview Skills : Simulation, Observation of exemplary interviews, Comment critically on simulated interviews, Interview Skills : Common Errors, Discuss the common errors generally candidates make in interview, Demonstrate an ideal interview

Unit II: Group Discussion Skills & Exploring career opportunities
Meaning and methods of Group Discussion, Procedure of Group Discussion, Group Discussion-Simulation, Group Discussion - Common Errors, 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 their potentials and availability of opportunities

Unit III: Presentation Skills, Trust and Collaboration
Types of presentations, Internal and external presentation, Knowing the purpose, Knowing the audience, Opening and closing a presentation, Using presentation tools, Handling questions, Presentation to heterogenic group, Ways to improve presentation skills over time, Explain the

importance of trust in creating a collaborative team, Agree to Disagree and Disagree to Agree – Spirit of Team work, Understanding fear of being judged and strategies to overcome fear

Unit IV: Listening as a Team Skill & Brainstorming

Advantages of Effective Listening, Listening as a team member and team leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no prethink, use empathy, listen to tone and voice modulation, recapitulate points, etc.)., Use of group and individual brainstorming techniques to promote idea generation., Learning and showcasing the principles of documentation of team session outcomes

Unit V: Social and Cultural Etiquette & Internal Communication

Need for etiquette (impression, image, earn respect, appreciation, etc), Aspects of social and cultural/corporate etiquette in promoting teamwork, Importance of time, place, propriety and adaptability to diverse cultures, Use of various channels of transmitting information including digital and physical, to team members.

Course Outcomes:

CO 1: Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax and Participate in a simulated interview

CO 2:Actively participate in group discussions towards gainful employment, Capture a self - interview simulation video regarding the job role concerned and Enlist the common errors generally made by candidates in an interview.

CO 3: Perform appropriately and effectively in group discussions and Explore sources (online/offline) of career opportunities

CO 4: Use common technology messaging tools that are used in enterprises for flow of information and transition from command and control to informal communication during an online/offline team session &Actively use and operate online team communication tools: Webinar, Skype, Zoom, Google hangout etc

CO 5: Appreciate and demonstrate Team Skills & Generate, share and maximise 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

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 between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L6	L	H	L	M	L	H	H	M	-	H	M	-	L	L
CO2	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	L
CO3	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	M
CO4	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	M
CO5	L3	L	H	L	M	L	H	H	M	-	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

BTMEESC508 :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.

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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	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	-----

BTMEPCC5089 :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:

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 sessional component shall include 30%

weight age to mini project.

Heat exchanger design for different applications, designing for thermal insulation, Use of relevant BIS codes for designing

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.

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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: Make 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

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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	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	

BTMEPSIT 512: Industrial Training & Seminar

CourseObjectives:
- Toacquireandapplyfundamentalprinciplesofengineering.
- Toidentify,formulateandpresentmodelproblems.
- Tofindengineeringsolutionsbasedona 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

BTMEPCC 513: Python Lab

Course Objective:
- To describe the need for Object-oriented programming concepts in Python.
- To infer the supported data structures like lists, dictionaries and tuples in Python.
- To illustrate the application of matrices and regular expressions in building the Python programs.
- To discover the use of external modules in creating excel files and navigating the file systems.

List of Experiments

1. Write a program to demonstrate basic data type in python.

2. Write a program to compute distance between two points taking input from the user

3. Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

4. Write a Program for checking whether the given number is an even number or not.

5. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . , 1/10

6. Write a Program to demonstrate list and tuple in python.

7. Write a program using for loop that loops over a sequence.

8. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

9. Find the sum of all the primes below two million.

10. By considering the terms in the Fibonacci sequence whose values do not exceed four million, WAP to find the sum of the even-valued terms.

11. Write a program to count the numbers of characters in the string and store them in a dictionary data structure.

12. Write a program to use split and join methods in the string and trace a birthday of a person with a dictionary data structure

13. Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?

14. Write a program to print each line of a file in reverse order.

15. Write a program to compute the number of characters, words and lines in a file.

16. Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on.

17. Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.

18. Write a program to implement Merge sort.

19. Write a program to implement Selection sort, Insertion sort.

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Course Outcomes:

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

CO1: Create, Test and Debug Python Programs

CO2: Implement Conditionals and Loops for Python Programs

CO3: Use functions and represent Compound data using Lists, Tuples and Dictionaries

CO4: Read and write data from & to files in Python and develop Application using Python.

CO5: Illustratesortmethods in Python Programs.

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 between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L6	H	M	M	M	M	-	-	-	L	M	L	L	M	M
CO2	L3	M	M	M	M	L	-	-	-	M	M	L	M	H	M
CO3	L2	H	L	H	L	M	-	-	-	L	L	L	M	H	H
CO4	L6	H	M	H	M	M	-	-	-	M	M	M	L	H	H
CO5	L3	M	M	M	M	L	-	-	-	M	M	L	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	CO2, CO3
CD3	Seminars	-

| CD4 | Self- learning advice using internets | CO2, CO3, CO4 |
| CD5 | Industrial visit | - |

BTMESODECA 514: Social Outreach, Discipline & Extra Curricular Activities

CourseObjectives:
- To allowingstudents to explorestrengthsand talents outside ofacademics.
- Tohelpingstudents developstrongertime-management andorganizationalskills.
- Togivingstudentstheopportunitytobuildfriendships andparticipateingroupactivitiesoutsideof thetight circleof theregular classroom.
- Tohelpingtobuildconfidence andself-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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 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

BTBSC515: ANANDAM

Objectives:

➢ To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.

➢ To inculcate the habit of service in students across the University.

➢ A compulsory course of 2 credits per semester to be included in each program of University.

➢ Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

➢ Do at least one act of individual service each day
➢ Record this act of service in a dedicated Register / Personal Diary
➢ Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
➢ Undertake one group service project for 64 hours every semester (outside college hours)
➢ Upload the report on the group project on the Anandam platform
➢ Participate in a sharing and presentation on the group service in the discussion sessions held once in week
➢ There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

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Semester - VI

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEESC601	Measurement & Metrology	Core	30	70	100	3	-	-	3
BTMEPCC602	Computer Integrated Manufacturing Systems	Core	30	70	100	3	-	-	3
BTMEPCC603	Mechanical Vibrations	Core	30	70	100	3	-	-	3
BTMEPCC604	Design of Machine Elements II	Core	30	70	100	3	-	-	3
BTMEPCC605	Non-Conventional Machining Methods	Core	30	70	100	3	-	-	3
BTMEPEC606.A	Refrigeration & Air Conditioning	Elective	30	70	100	3	-	-	3
BTMEPEC606.B	Machine Learning	Elective	30	70	100	3	-	-	3
BTMEPEC606.C	Micro electro and mechanical systems (MEMS) and Microsystems	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC607	CIMS Lab	Core	30	20	50	-	-	1	1
BTMEPCC608	Vibration Lab	Core	30	20	50	-	-	1	1
BTMEPCC609	Machine Design Practice II Lab	Core	30	20	50	-	-	1	1
BTMEPCC610	Thermal Engineering Lab	Core	30	20	50	-	-	1	1
BTMEPSIT611	Industrial Training/ Seminar	Core	30	20	50	-	-	1	1
BTMEPCC612	Machine Learning Lab	Core	30	20	50	-	-	1	1
BTMESODECA613	Social Outreach, Discipline & Extra Curricular Activates		50	-	50	-	-	-	1
BTBSC 614	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**460**	**590**	**1050**	**19**	**0**	**7**	**27**

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BTMEESC601 :Measurement & Metrology

Course Objectives:
- To understand procedure and importance of measurement in engineering
- To acquire skills of various measuring tools.

Syllabus

Unit 1: 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 2: 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 3: 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 4: 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 5: 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

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BTMEPCC602 :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

Syllabus

Unit 1: Introduction: Objective, scope and outcome of the course. Introduction to CIM:Overview of Production Systems, the productcycle, Automation in Production Systems, computer's role inmanufacturing, 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. ComputerNumerical Control (CNC): features of CNC, machine control unit,CNC software. Direct Numerical Control and DistributedNumerical Control. Applications, advantages and disadvantages ofNC.Adaptive control of machining system.

Unit 2: NC Part programming: Manual and computer assisted partprogramming, Part programming with APT. NC part programmingusing CAD/CAM software. NC cutter path verification.

Unit 3: 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 classificationand coding, coding system and machining cells.

Unit 4: Computer Aided Production Management Systems: Introduction tocomputer aided PPC, Introduction to computer aided inventorymanagement, manufacturing resource planning (MRPII), computerprocess 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 5: Computer Aided Material Handling; Computer control on materialhandling, conveying, picking. Ware house control, computerizedmaterial 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:
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.

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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. 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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	CO2, CO3, CO4, CO5

	internets	
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.

Syllabus

Unit 1: 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 2: 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 3: 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 4: 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 5: 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: Solve 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

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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	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

Syllabus

Unit 1: Introduction: Objective, scope and outcome of the course. Fatigue Considerations in Design: Variable load, loadingpattern, endurance stresses, Influence of size, surface finish, notchsensitivity and stress concentration.

Unit 2: Goodman line, Soderberg line, Design of machine memberssubjected to combined, steady and alternating stresses. Design for finite life, Design of Shafts under Variable Stresses,Bolts subjected to variable stresses.

Unit 3: Design of IC Engine components:Piston, Cylinder, Connecting Rod and Crank Shaft. Design of helical compression, tension, torsional springs, springsunder variable stresses.

Unit 4: Design of belt, rope and pulley drive system, Design of gear teeth: Lewis and Buckingham equations, wearand dynamic load considerations. Design and force analysis of spur, helical, bevel and worm gears, Bearing reactions due to gear tooth forces.

Unit 5: Design of Sliding and Journal Bearing: Methods oflubrication, hydrodynamic, hydrostatic, boundary etc. Minimum filmthickness 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: GetKnowledge of Fatigue Considerations in Design

CO2:Understand shafts design.

CO3: Understanddesign 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

BTMEPEC605 :Non Conventional Machining Methods

Objectives:

- To understand unconventional techniques and processes of manufacturing
- To impart knowledge to develop a product with the required quality at a reasonable price and to satisfy the requirements under various quality standards

Syllabus

Unit1: Introduction and classification of advanced machining process, consideration in process selection, difference between traditional and non-traditional process, Hybrid process.Abrasivefinishingprocesses:AFM,MAF(forPlainandcylindricalsurfaces).

Unit2:

Mechanicaladvancedmachiningprocess:Introduction,Mechanicsofmetalremoval,processprinciple, Advantages,disadvantagesandapplicationsofAJM,USM,WJC.

Unit3:

Thermoelectricadvancedmachiningprocess:Introduction,Principle,processparameters,advantages, disadvantagesandapplicationsaboutEDM,EDG, LBM,PAM,EBM

Unit4:

Electrochemicalandchemicaladvancedmachiningprocess:ECM,ECG,ESD,Chemicalmachining,A nodeshapeprediction andtooldesignforECMprocess.Tool(cathode)designforECMProcess.

Unit5: IntroductiontoMicroandnanomachining

Suggested Text / Reference Books:

1. Modern Machining Process by Pandey and Shah
2. Advanced Analysis of Nontraditional Machining by Hong Hocheng
3. Nontraditional Machining Processes by E Weller
4. Non-Traditional Machining Processes by Jagadeesha T
5. Nontraditional Machining Processes: Research Advances by J Paulo Davim

Course Outcomes:

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

CO1: Understand Non-Conventional sources of energy technologies

CO2: Understand various renewable energy technologies and systems.

 CO3: Classify storage technologies from the autonomous renewable energy sources

CO4: Understandvarious possible mechanisms about renewable energy projects

CO5: UnderstandMicroandnanomachining

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	M	M	M	-	M	M	-	M	M	-	L	M	M
CO2	L2	H	M	M	M	-	M	M	-	M	M	-	M	M	M
CO3	L2	M	M	M	M	-	M	M	-	L	M	-	M	M	M
CO4	L2	M	M	M	M	-	M	M	-	L	M	-	H	M	M
CO5	L2	M	M	M	M	-	M	M	-	L	M	-	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
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	-

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
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using	CO2, CO3, CO4

	internets	
CD5	Industrial visit	-

BTMEPEC606.A: Refrigeration and Air Conditioning

Objectives:

- To understand concept of refrigeration
- To impart knowledge to develop a product with the required qualityfor air conditioning

Syllabus

Unit1:**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 2:

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 3:

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 4:

Psychrometry: Psychrometric properties, psychometric relations, pyschrrometric 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 5:

Cooling load calculations: Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychrometric 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: Illustrate the fundamental principles and applications of refrigeration and air conditioning system

CO2: Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems

CO3: Present the properties, applications and environmental issues of different refrigerants

CO4: Calculate cooling load for air conditioning systems used for various

CO5: Operate and analyze the refrigeration and air conditioning 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

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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	M	M	M	M	-	M	M	-	M	M	-	L	M	M
CO2	L2	M	M	M	M	-	M	M	-	M	M	-	M	M	M
CO3	L4	L	M	M	M	-	M	M	-	L	M	-	M	M	M
CO4	L2	M	M	M	M	-	M	M	-	L	M	-	H	M	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
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	CO1,CO2, CO3, CO4, CO5

BTMEPEC 606.B : Machine Learning

Course Objectives:

- To introduce students to the basic concepts and techniques of **Machine Learning**.
- To develop skills of using recent **machine learning** software for solving practical problems.
- To gain experience of doing independent study and research.

Syllabus

UNIT I:

Supervised learning algorithm: Introduction, types of learning, application, Supervised learning: Linear Regression Model, Naïve Bayes classifier Decision Tree, K nearest neighbor, Logistic Regression, Support Vector Machine, Random forest algorithm

UNIT II:

Unsupervised learning algorithm: Grouping unlabelled item susing k-means clustering, Hierarchical Clustering, Probabilistic clustering, Association rule mining, Apriori Algorithm, f-p growth algorithm, Gaussian mixture model.

UNIT III:

Introduction to Statistical Learning Theory, Feature extraction-Principal component analysis, Singular value decomposition. Feature selection–feature ranking and subset selection, filter, wrapper and embedded methods, Evaluating Machine Learning algorithms and Model Selection.

UNIT IV:

Semi supervised learning, Reinforcement learning : Markov decision process (MDP), Bellman equations, policy evaluation using Monte Carlo, Policy iteration and Value iteration, Q-Learning, State-Action-Reward-State-Action (SARSA), Model-based Reinforcement Learning.

UNIT V:

Recommended system, Collaborative filtering, Content-based filtering Artificial neural network, Perceptron, Multilayer network, Back propagation, Introduction to Deep learning.

Refrence/Text Books:

- Tom M Mitchell, Machine Learning, McGraw Hill Education
- Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
- Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.
- Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
- Introduction to MachineLearning - Ethem Alpaydin, MIT Press, Prentice hall of India.

Course Outcomes:

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

CO1: Describe intelligent agents for search and games

CO2: Convert AI problems through programming with Python

CO3: Learning optimization and inference algorithms for model learning

CO4: Make programs for an agent to learn and act in a structured environment.

CO5: Learn recommended system in ML.

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	L1	H	M	M	M	M	M	-	-	-	M	-	M	M	M
CO2	L2	M	M	H	M	L	-	-	-	-	M	-	L	M	M
CO3	L1	M	H	M	H	-	-	-	-	-	H	-	L	H	M
CO4	L3	H	M	H	M	M	-	M	-	-	M	-	L	H	M
CO5	L1	M	H	M	H	-	-	-	-	-	H	-	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,CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3

CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO4

BTMEPEC606C :MEMS and Microsystems

Course Objectives:
- To understand different aspects of microelectromechanical Systems.
- To familiarize the working of microsystem design and fabrication
- To expose the principles of thermo fluid engineering

Syllabus

Unit 1: Over view of MEMS and Microsystems: Microelectromechanical Systems(MEMS) and Microsystems, Typical MEMS and Microsystem products, Evaluation of Microfabrication, Microsystem and microelectronics, themultidisciplinary nature of microsystem design and manufacture,Microsystems and miniaturization, Application of Microsystems in theautomotive industry, applications of Microsystems in other industries. Working Principles of Microsystems: Introduction, Microsensors,Microactuation, MEMS with Microactuators, Microaccelerometers,Microfluidics.

Unit2: Engineering Science forMicrosystem Design and Fabrication:Introduction, atomic structure of matter, ions and ionization, molecule theory of matter and intermolecular forces, doping of semiconductors, thediffusion process, plasma physics, electrochemistry, quantum physics. Engineering Mechanics for Microsystem design: Introduction, staticbending of thin plates, mechanical vibration, thermomechanics,fracturemechanics, thin-film mechanics, overview of finite element stress analysis.

Unit3: Thermofluid Engineering andMicrosystem design: Introduction, overviewof the basics of fluid mechanics in Macro and mesoscales, Basic equationsin continuum fluid dynamics, laminar fluid flow in circular conduits,computational fluid dynamics, Incompressible fluid flow in microconduits,fluid flow in submicrometer and nanoscale, overview of heat conduction insolids, heat conduction in multilayered thin films, heat conduction insolids in sub micrometer scale. Scaling laws in Miniaturization: Introduction to scaling, scaling ingeometry, scaling in rigid-body dynamics, scaling in electrostatic forces,scaling in electromagnetic forces, scaling in electricity, scaling in fluidmechanics, scaling in heat transfer.

Unit4: Materials for MEMS and Microsystems:Introduction, substrateandwafers, active substrate materials, silicon as a substrate material, siliconcompounds, silicon piezoresistors, gallium arsenide, quartz, piezoelectriccrystals, polymers, packaging materials.5Microsystem Fabrication Processes:Introduction,Photolithography, Ionimplantation, diffusion, oxidation, chemical vapor deposition, physicalvapor deposition-sputtering, deposition by epitaxy, etching.

Unit5: Overview of Micromanufacturing: Introduction, bulk micromanufacturing,surface micro machining, LIGA. Microsystem Design: Introduction, design consideration, process design,mechanical design, mechanical design using finite element method,design of silicon die

for a micropressure sensor, design of microfluidicnetwork systems, design case:capillary electrophoresis network system.

Suggested Text / Reference Books:
1. MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering
   By Tai-Ran Hsu
2. Foundation of MEMS" by Chang Liu. Pearson Education.
3. Rai - Choudhury P. "MEMS and MOEMS Technology and Applications",
   PHI Learning Private Limited, 2009.
4. Sabrie Solomon, "Sensors Handbook," Mc Graw Hill, 1998.
5. Marc F Madou, "Fundamentals of Micro Fabrication", CRC Press, 2nd
   Edition, 2002.

Course Outcomes:

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

CO1: Design MEMS components.

CO2: Explain the various MEMS fabrication technologies.

CO3: Describe the mechanical, thermal, electrical, magnetic and chemical properties of material.

CO4: Discuss the lumped modeling of systems and transducers.

CO5: Interpret the micro system dynamics.

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	L6	H	M	H	M	H	-	-	-	-	L	-	L	M	M
CO2	L2	H	M	H	M	M	-	-	-	-	L	-	M	L	M
CO3	L2	H	H	H	H	M	-	-	-	-	L	-	-	M	L
CO4	L2	H	H	M	H	H	-	-	-	-	L	-	-	L	M
CO5	L4	M	M	M	M	H	-	-	-	-	L	-	M	M	L

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

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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	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTMEPCC607 :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. Miniproject shall be a group activity. A group shall consist of maximum fivestudents. 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

BTMEPCC608 :Vibration Lab

Course Objectives:
- To understand measurement and analysis techniquesof 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 $T = 2\pi\sqrt{(l/g)}$ 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

BTMEPCC609 :Machine Design Practice II Lab

Course Objectives:
- To apply measurement and analysis techniques to mechanical compression and tension systems
- To formulate mathematical models and designtransmission 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	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	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	---

B. Tech. (ME)

BTMEPCC610 :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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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	------

BTMEPSIT 611: Industrial Training & Seminar

CourseObjectives:
- Toacquireandapplyfundamentalprinciplesofengineering.
- Toidentify,formulateandpresentmodelproblems.
- Tofindengineeringsolutionsbasedona 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

BTCSPCC 612: Machine Learning Lab

Course Objective:

- To Make use of Data sets in implementing the machine learning algorithms
- To Analyze and evaluate simple algorithms for pattern classification.
- To implement the machine learning concepts and algorithms in any suitable language of choice.

List of Experiments

1. Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample

4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Course Outcomes:

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

CO1: Build intelligent agents for search and games

CO2: Solve AI problems through programming with Python

CO3: Learning optimization and inference algorithms for model learning

CO4: Design and develop programs for an agent to learn and act in a structured environment.

CO5 : Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.

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 between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	P01 1	PO1 2	PSO 1	PSO 2
CO1	L6	H	M	H	M	M	-	-	-	L	M	-	L	M	M
CO2	L5	M	M	H	M	L	-	-	-	L	M	-	M	H	M
CO3	L1	H	L	H	L	L	-	-	-	L	L	-	M	H	H
CO4	L6	H	M	H	M	M	-	-	-	M	M	-	L	H	H
CO5	L3	M	M	M	M	L	-	-	-	M	M	L	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
CD2	Tutorials/Assignments	CO2, CO3,CO5
CD3	Seminars	-

CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	-

BTMESODECA 613: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:
- To allowingstudents to explorestrengthsand talents outside ofacademics.
- Tohelpingstudents developstronger time-managementand organizationalskills.
- Togivingstudentstheopportunitytobuildfriendships andparticipateingroupactivitiesoutsideof thetight circleof theregular classroom.
- Tohelpingtobuildconfidence andself-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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

BTBSC 614: ANANDAM

Objectives:

➤ To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.

➤ To inculcate the habit of service in students across the University.

➤ A compulsory course of 2 credits per semester to be included in each program of University.

➤ Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

➤ Do at least one act of individual service each day
➤ Record this act of service in a dedicated Register / Personal Diary
➤ Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
➤ Undertake one group service project for 64 hours every semester (outside college hours)
➤ Upload the report on the group project on the Anandam platform
➤ Participate in a sharing and presentation on the group service in the discussion sessions held once in week
➤ There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

B. Tech. (ME)

Semester - VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPCC701	I.C. Engines	Core	30	70	100	3	-	-	3
BTMEPCC702	RAC	Core	30	70	100	3	-	-	3
BTMEPCC703	Computer Added Design	Core	30	70	100	3	-	-	3
BTMEOEC704.A	Power Generation Sources	Elective	30	70	100	3	-	-	3
BTMEOEC704.B	Environmental Engineering and Disaster Management	Elective	30	70	100	3	-	-	3
BTMEOEC704.C	Non-Destructive System	Elective	30	70	100	3	-	-	3
BTMEPCC705	Research and publication ethics	Core	30	70	100	3	-	-	3
BTBSC 706	Leadership & Management Skills	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC707	I.C. Engines Lab	Core	30	20	50	-	-	1	1
BTMEAPCC708	RAC Lab	Core	30	20	50	-	-	1	1
BTMEAPCC709	FEA Lab	Core	30	20	50	-	-	1	1
BTMEPSIT710	IndustrialTraining	Core	60	40	100	-	-	2	2
BTMEPSIT711	Project I	Core	60	40	100	-	-	2	2
BTMESODECA712	Social Outreach, Discipline & Extra Curricular Activity		50	-	50	-	-	-	1
BTBSC 713	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**490**	**610**	**1100**	**19**	**0**	**8**	**28**

B. Tech. (ME)

BTMEPCC701: 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

Syllabus

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, Carburettors, types, Aircraft carburettor, comparison of carburetion & injection, F/A ratio calculations.

Unit-IV

CI engine: Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

BTMEPCC702: Refrigeration and Air Conditioning
Syllabus

Course Objectives:
- To familiarize with the terminology associated with refrigeration and conditioning.
- To understand the basics of refrigerator.

Unit1:**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 2:
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 3:
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 4:

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 5:

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

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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	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

BTMEPCC703: Computer Added Design

Syllabus

Course Objectives:
- To familiarize with the terminology associated with computer aided design.
- To understand the basics of drafting.

UNIT-I

Introduction: Definition and scope of CAD/CAM, Introduction to design process and role of computers in the design process.

UNIT-II

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Transformations: 2D and 3D transformations.

UNIT-III

Curves and Surfaces: Analytical, Synthetic curves with advantages, Disadvantages, Comparison with parametric curves, Geometric modeling curves and surfaces, Representation, Wire frame models, Parametric representations, Parametric curves and surfaces

UNIT-IV

Solid modeling: Solid models, Fundamentals of solid modeling, Different solid representation schemes, Half -spaces, Boundary representation (B-rep), Constructive solid geometry (CSG), Sweep representation

UNIT-V

CAD/CAM Data Exchange Formats: Types of file formats & their exchange, Graphics standards.

Recommended Books

1. Zeid, I., CAD/CAM, McGraw Hill (2008).

2. Rogers, D. F. and Adams, J. A., Mathematical Elements for Computer Graphics, McGraw Hill (1989).

3. Rogers, D. F., Procedural Elements for Computer Graphics, McGraw Hill (2008).

4. Rooney, J. and Steadman, P., Principles of Computer Aided Design, prentice Hall (1988). 5. Rooney, J. and Steadman, P., Computer Aided Design, Pitman/Open University (1987).

Course Outcomes:
At the end of the course, the student will be able to:
CO1: Understand various types of CAD models.
CO2: Analyze the various transformations.
CO3: Identify curves and surfaces.
CO4: Understand Constructive solid geometry
CO5: Evaluate and analyzeof file formats & their exchange

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

B. Tech. (ME)

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	H	H	M	-	-	-	-	L	-	L	M	L
CO2	L4	H	M	H	M	M	-	-	-	-	L	-	L	L	M
CO3	L2	M	H	H	H	M	-	-	-	-	L	-	L	L	L
CO4	L2	H	M	H	H	M	-	-	-	-	L	-	L	H	M
CO5	L5	M	M	H	M	M	-	-	-	-	L	-	L	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	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: 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.

Syllabus

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

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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	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

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: Environmental Engineering and Disaster Management

Course Objectives:

- To understand the basics of different disasters.
- To understand the basics of different tools and methods for disaster management.

Syllabus

Unit-I

Introduction: Objective, scope and outcome of the course. (This compulsory for all course)

Unit-II

Importance of safe water supply system.Domestic water requirements for urban and rural areas.Sources of Water supply.Intakes and transportation of water.

Unit-III

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Drinking water quality. Indian Standards of drinking water. Introduction to water treatment for safe drinking, Importance of sanitation.

Unit-IV

Domestic waste water: quantity, characteristics, disposal in urban and rural areas. Sewer: types, design discharge and hydraulic design. Introduction to domestic wastewater treatment.

Unit-V

Solid waste: quantity, characteristics and disposal for urban and rural areas. Introduction to air pollution.Types of pollutants, properties and their effects on living beings.BIS standards for pollutants in air and their abetments. Introduction to various disaster, Importance of disaster management.

Suggested Text / Reference Books:

1. Engineering and Disaster Management by Sanjay K Sharma
2. Disaster Management and Mitigation by Prof R B Singh
3. Disaster Mitigation: Experiences And Reflections by Alka Dhameja and Pardeep Dhameja.
4. Disaster Management: Disaster Management and Mitigation approaches in india by Paritosh Srivastava.
5. Management and Mitigation of Natural Disasters" by Rajan Kumar Sahoo

Course Outcomes:

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

CO1: Understand Disasters, man-made Hazards and Vulnerabilities

CO2: Understand disaster management mechanism

CO3: Understand capacity building concepts and planning of disaster managements

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	L2	H	H	H	H	H	-	L	-	-	L	-	L	M	M
CO2	L2	H	M	H	M	M	-	L	-	-	L	-	L	M	M
CO3	L2	H	H	H	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
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO1, CO2, CO3
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO1, CO2, CO3

BTMEOEC704.C: Non Destructive System

Course Objectives:
- To familiarize with the different testing machines.
- To understand the basics of non destructive tastings.

Syllabus

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.

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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 methodtesting

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

B. Tech. (ME)

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

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BTMEPCC705: RESEARCH AND PUBLICATION ETHICS (RPE)

Course Objectives:

- To identify the concept of research.
- To identify the scientific conduct of research.
- To understand the publication Ethics.

Unit01: PHILOSOPHY ANDETHICS
1. Introduction to Philosophy : definition, nature and Scope, Concept,Branches
2. Ethics: definition, moral philosophy, nature of moral judgements andreaction

Unit 02: SCIENTIFICCONDUCT
1. Ethics with respect to science andresearch
2. Intellectual honesty and researchintegrity
3. Scientific misconducts: Falsification, Fabrication, andPlagiarism(FFP)
4. Redundant publications: duplicate and overlapping publications, salamislicing
5. Selective reporting and misrepresentation ofdata.

Unit 03: PUBLICATIONETHICS
1. Publication ethics: definition, introduction andimportance
2. Best practices /Standards setting initiatives and guidelines: COPE. WAME,etc.,
3. Conflicts ofinterest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa,types
5. Violation of publication ethics, authorship andcontributorship
6. Identification of publication misconduct, complaints andappeals
7. Predatory publishers andjournals

Unit 04: OPEN ACCESSPUBLISHING AND PUBLICATIONMISCONDUCT

1. Open access publications andinitiatives
2. SHEERPA/RoMEO online resource to check publisher copyright & Self – archivingpolicies
3. Software tool to identify predatory publications developed bySPPU
4. Journal finder /Journal suggestion tools viz.JANE., Elsevier journal Finder, SpringerJournal Suggester,etc.
5. Subject specific ethical issues, FFP, authorship
6. Conflicts of interest
7. Complaints and appeals: examples and fraud from India andabroad.

8. Use of plagiarism software like Turnitin, Urkund and other open source software tools

Unit 05: DATABASES AND RESEARCHMETRICS

A. Databases
   1. Indexingdatabases
   2. Citation databases: Web of Science, Scopus,etc.
B. ResearchMetrics
   1. Impact Factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, CiteScore
   2. Metrics: h-index, g index, i10 index,altmetrics

Reference:

- Bird, A.(2006). Philosophy of Science.Routledge

- Maclntyre, Alasdair (1967) A Short History of Ethics. London

Course Outcomes:

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

CO1: Understand the concept of research.

CO2: Understand the scientific conduct of research.

CO3: Understand the publication Ethics.

CO4: Understand Open access publications and publication misconduct. ct.

CO5: Understand the Research Data and Research Metrics.

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	M	H	H	-	-	-	-	H	-	L	M	M
CO2	L2	M	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	M	M	M	M	M	-	-	-	-	M	-	L	M	M

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

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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	CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4, CO5
CD5	Industrial visit	CO5

BTBSC 706 Leadership & Management Skills

Course Objectives:
- To help students to develop essential skills to influence and motivate others
- To inculcate emotional and social intelligence and integrative thinking for effective leadership

Course Contents
Unit I - Leadership Skills
Understanding Leadership and its Importance:What is leadership?Why Leadership required? Whom do you consider as an ideal leader? Traits and Models of Leadership: Are leaders born or made? Key characteristics of an effective leader, Leadership styles, Perspectives of different leaders. Basic Leadership Skills: Motivation, Team work, Negotiation, Networking. Innovative Leadership.Concept of emotional and social intelligence, Synthesis of human and artificial intelligence, Why does culture matter for today's global leaders.
Unit II Managerial Skills
Basic Managerial Skills, Planning for effective management, How to organise teams? Recruiting and retaining talent, Delegation of tasks, Learn to coordinate, Conflict management, Self Management Skills, Understanding self concept, Developing self-awareness, Self-examination, Self-regulation.
Unit III Entrepreneurial Skills
Basics of Entrepreneurship: Meaning of entrepreneurship, Classification and types of entrepreneurship, Traits and competencies of entrepreneur, Creating Business Plan, Problem identification and idea generation, Idea validation, Pitch making.
Unit IV   Design Thinking
Design Thinking: What is design thinking? Key elements of design thinking: Discovery, Interpretation, Ideation- Experimentation – Evolution, How to transform challenges into pportunities? How to develop human-centric solutions for creating social good?
Unit V   Ethics and Integrity
Learning through Biographies: What makes an individual great? Understanding the persona of a leader for deriving holistic inspiration, Drawing insights for leadership, How leaders sail through difficult situations? Ethics and Conduct, Importance of ethics, Ethical decision making, Personal and professional moral codes of conduct, Creating a harmonious life

Text Books:
1. Ashokan, M. S. (2015). *Karmayogi: A Bbiography of E. Sreedharan*. Penguin, UK.
2. Brown, T. (2012). *Change by Design.* Harper Business
3. Kalam A. A. (2003). *Ignited Minds: Unleashing the Power within India*. Penguin Books India
4. Kelly T., Kelly D. (2014). *Creative Confidence: Unleashing the Creative Potential Within Us All.* William Collins
5. McCormack M. H. (1986).*What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive*. RHUS

Suggested Readings:
- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2004). *International Handbook of Intelligence*. Cambridge University Press.
E-Resources
- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/talks/anil_gupta_india_s_hidden_hotbeds_of_invention

Course Outcomes:

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

CO1: Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own 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, team leadership, etc.

CO3: Understand the basics of entrepreneurship and develop business plans

CO4: Apply the design thinking approach for leadership

CO5: Discuss the importance of ethics and moral values for making of a balanced personality

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L4	M	M	-	-	M	M	M	H	-	L	L	-	M	M
CO2	L3	M	M	M	M	M	M	L	M	-	M	M	-	M	M
CO3	L2	M	M	M	H	M	M	M	M	-	L	L	-	M	M
CO4	L3	M	M	M	M	M	M	M	H	-	L	L	-	M	M
CO5	L1`	-	M	L	H	H	H	M	M	-	L	L	-	M	M

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

Mapping between CO and CD

B. Tech. (ME)

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: 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:

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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	----

BTMEPCC708 RAC Lab

Course Objectives:
- To understand the importance of refrigeration
- To get the knowledge of various conditioning properties.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

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

11.

12. **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: FEA Lab

Course Objectives:
- To understand the importance of automation for problem solving
- To get the knowledge of various finite elements methodsbased 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.

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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	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	----

BTMEPSIT 710: Industrial Training

CourseObjectives:
- Toacquireandapplyfundamentalprinciplesofengineering.

- Toidentify,formulateandpresentmodelproblems.
- Tofindengineeringsolutionsbasedona 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

BTMEPSIT711: PROJECT

Course Objective:
- To introduce the concept and methods required for the construction of large softwareintensivesystem.
- 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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 712: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:
- To allowingstudents to explorestrengthsand talents outside ofacademics.
- Tohelpingstudents developstronger time-managementand organizationalskills.
- Togivingstudentstheopportunitytobuildfriendships andparticipateingroupactivitiesoutsideof thetight circleof theregular classroom.
- Tohelpingtobuildconfidence andself-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

B. Tech. (ME)

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

BTBSC 713: ANANDAM

Objectives:

➢ To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.

➢ To inculcate the habit of service in students across the University.

➢ A compulsory course of 2 credits per semester to be included in each program of University.

➢ Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

➢ Do at least one act of individual service each day
➢ Record this act of service in a dedicated Register / Personal Diary
➢ Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
➢ Undertake one group service project for 64 hours every semester (outside college hours)
➢ Upload the report on the group project on the Anandam platform
➢ Participate in a sharing and presentation on the group service in the discussion sessions held once in week
➢ There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - VIII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTMEPEC801.A	Hybrid and Electric Vehicles	Elective	30	70	100	3	-	-	3
BTMEPEC801.B	Supply and Operations Management	Elective	30	70	100	3	-	-	3
BTMEPEC801.C	Additive Manufacturing	Elective	30	70	100	3	-	-	3
BTMEOE802.A	Finite Elements Methods	Elective	30	70	100	3	-	-	3
BTMEOE802.B	Energy Management	Elective	30	70	100	3	-	-	3
BTMEOE802.C	Waste and By-product Utilization	Elective	30	70	100	3	-	-	3
BTMEOE802.D	Medium And Small Enterprises Management	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTMEPCC803	Industrial Engineering Lab	Core	30	20	50	-	-	1	1
BTMEPCC804	Metrology Lab	Core	30	20	50	-	-	1	1
BTMEPRJ805	Project	Core	210	140	350	3	-	4	7
BTMEESODECA806	Social Outreach, Discipline & Extra		50	-	50	-	-	-	1

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BTBSC 807	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			**430**	**370**	**800**	**10**	**0**	**7**	**18**

BTMEPCC801.A: Hybrid and Electric Vehicles

Course Objective:
- To Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals..
- To understand and discuss different energy storage technologies used for hybrid electric vehicles and their control.
- To analyze various electric drives suitable for hybrid electric vehicles.

Syllabus

Unit-I

Introduction: Objective, scope and outcome of the course.
Overview of Rapid Product Development (RPD): Need for thecompression 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, Pathgeneration, Applications.

Unit-III

Solid Ground Curing: Principle of operation, Machine details,Applications. Laminated Object Manufacturing: Principle ofoperation, 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 andInvestment Casting, Cast kirksite, 3Q keltool, etc.

Unit-IV

Direct RT processes: Laminated Tooling, Powder Metallurgybased technologies, Welding based technologies, Direct patternmaking (Quick Cast, Full Mold Casting),
Emerging Trends in RT, Reverse Engineering: Geometric dataacquisition, 3D reconstruction, Applications and Case Studies,Engineering applications, Medical applications.

Unit-V

Processing Polyhedral Data: Polyhedral B-Rep modeling, STLformat, 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: Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals..
CO2: Analyse the use of different power electronics devices and electrical machines in hybrid electric vehicles.
CO3: Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control and select appropriate technology
CO4: Interpret working of different configurations of electric vehicles and its components,
CO5: UnderstandHybrid vehicle configuration, performance analysis and Energy Management strategies in HEVs

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

B. Tech. (ME)

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

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

BTMEPCC801.B: Supply and Operations Management

Course Objective:

- To develop an understanding of how the operations, have strategic importance and can provide a competitive advantage in the workplace.
- To understand the relationship between operations and other business functions.
- To understand techniques of location and facility planning; line balancing; job designing; and capacity planning in operations management.
- To understand the Materials Management function starting from Demand Management through
  Inventory Management.

Syllabus

Unit-I

Introduction: Objective, scope and outcome of the course.

Overview of Rapid Product Development (RPD): Need for thecompression 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, Pathgeneration, Applications.

Unit-III
Solid Ground Curing: Principle of operation, Machine details,Applications. Laminated Object Manufacturing: Principle ofoperation, 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 andInvestment Casting, Cast kirksite, 3Q keltool, etc.

Unit-IV
Direct RT processes: Laminated Tooling, Powder Metallurgybased technologies, Welding based technologies, Direct patternmaking (Quick Cast, Full Mold Casting),
Emerging Trends in RT, Reverse Engineering: Geometric dataacquisition, 3D reconstruction, Applications and Case Studies,Engineering applications, Medical applications.

Unit-V
Processing Polyhedral Data: Polyhedral B-Rep modeling, STLformat, Defects and repair of STL files,
Introduction to software for RP : Brief overview of Solid view,magics etc.

Suggested Text / Reference Books:
1. Operation management by W J Stevenson, MGH
2. Operation management by Richard B Chase, MGH

Course Outcomes:
At the end of the course, the student will be able to:
CO1: Identify the elements of operations management and various transformation processes to enhance productivity and competitiveness.
CO2: Analyze and evaluate various facility alternatives and their capacity decisions, develop a balanced line of production & scheduling and sequencing techniques in operation environments
CO3: Develop aggregate capacity plans and MPS in operation environments.
CO4: Plan and implement suitable materials handling principles and practices in the operations.
CO5: Plan and implement suitable quality control measures in Quality Circles to TQM

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

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

BTMEPCC801.C: Additive Manufacturing

Course Objective:
- To understand technology used in additive manufacturing.
- To understand importance of additive manufacturing in advance manufacturing process.
- To acquire knowledge, techniques and skills to select relevant additive manufacturing process.
- To explore the potential of additive manufacturing in different industrial sectors.

Syllabus

Unit-I

Introduction: Objective, scope and outcome of the course.
Overview of Rapid Product Development (RPD): Need for thecompression 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, Pathgeneration, Applications.

Unit-III

Solid Ground Curing: Principle of operation, Machine details,Applications. Laminated Object Manufacturing: Principle ofoperation, 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 andInvestment Casting, Cast kirksite, 3Q keltool, etc.

Unit-IV

Direct RT processes: Laminated Tooling, Powder Metallurgybased technologies, Welding based technologies, Direct patternmaking (Quick Cast, Full Mold Casting),
Emerging Trends in RT, Reverse Engineering: Geometric dataacquisition, 3D reconstruction, Applications and Case Studies,Engineering applications, Medical applications.

Unit-V

Processing Polyhedral Data: Polyhedral B-Rep modeling, STLformat, 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: Understandprocessing 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

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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

BTMEOE802.A: Finite Elements Methods

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.

Syllabus

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 elementformulations 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

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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	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

BTMEOE802.B: Energy Management

Course Objective:
- To identify the energy management skills and strategies in the energy managment system.
- To understand various energy conservation methods useful in a particular industry.
- To prepare an energy audit report.

Syllabus

Unit-I

Introduction: Objective, scope and outcome of the course.

Unit-II

Energy Basics; 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

B. Tech. (ME)

<div align="center">**BTMEOE802.C: Waste and By-product Utilization**</div>

Objectives:
- To understand the type of waste and by products, waste identification, classificationand composition.
- To know the need for waste treatment and utilization

<div align="center">**Syllabus**</div>

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

Unit-II
Types and formation of byproducts and waste; magnitude of wastegeneration in different agro-processing industries; concept scopeand maintenance of waste management and effluent treatment,basics pf Waste Recycling & Resources Recovery System (WRRRS),Temperature, pH, Oxygen demands (BOD, COD), fat, oil andgrease content, metal content, forms of phosphorous and sulphurin waste waters, microbiology of waste, other ingredients likeinsecticide, pesticides and fungicides residues.

Unit-III
Waste utilization in various industries, furnaces and boilersrun on agricultural wastes and byproducts, briquetting ofbiomass as fuel, production of charcoal briquette, generation ofelectricity using surplus biomass, producer gas generation andutilization.

Unit-IV
Waste treatment and disposal, design, construction, operation andmanagement of institutional community and family size biogasplants, concept of vermi-composting, Pre-treatment of waste:sedimentation, coagulation, flocculation and floatation, Secondarytreatments: Biological and chemical oxygen demand for differentfood plant waste– trickling filters, oxidation ditches, activatedsludge process, rotating biological contractors, lagoons.

Unit-V
Tertiary treatments: Advanced waste water treatment process-sand,coal and activated carbon filters, phosphorous, sulphur, nitrogenand heavy metals removal, Assessment, treatment and disposal ofsolid waste.

Suggested Text / Reference Books:
1. Waste and By-product Utilization By Dr. S. K. Singh

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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

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 ofUnits, 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 andArtisans.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:

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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 ofSickness 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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: Industrial Engineering Lab

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-machinecharts 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 plannedorder release (POR) using MRP format
6. To solve the operations research problems on Linear programming/Transportation/Assignment etc. using OR software's likeTORA/LINGO/LINDO/SAS/EXCEL SOLVER etc.
7. Simulation of inventory system/Queuing system/production system usingMonte-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.

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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	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

Important Note:

It is mandatory for every student to undertake a Mini project. The mini projectshall involve a detailed project report of establishing a factory in which plant location, plant layout, capacity planning, selection of processes, ergonomically designing of equipments and other facilities are to be installed. 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.

BTMEPCC804: Metrology Lab

COURSE OBJECTIVES:

•ToMeasure linear and angular dimensions
•To perform various alignment tests on machine tools

•To Measurethe 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 the use of instruments for measuring linear (internal and external), angular dimensions and surface roughness.

CO2. Perform alignment tests on various machine tools.

CO3.Demonstrate the use of instruments for measuring pressure, flow, speed, displacement and temperature

CO4.Calibrate the Bourdon tube pressure gauge

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	PO11	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	M	-	-	-	-	M	-	L	M	M
CO2	L3	H	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L3	H	M	H	M	M	-	-	-	-	M	-	L	M	M
CO4	L4	H	M	H	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
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

BTMEPRJ 805: PROJECT

Course Objective:
- To introduce the concept and methods required for the construction of large softwareintensivesystem.
- Todevelopabroadunderstandingofthedisciplineofsoftwareengineeringandmanagementofsoftwaresystem.
- To provide an understanding of both theoretical and methodological issues involve

inmodernsoftwareengineeringprojectmanagementandfocusstronglyonpracticalt echniques

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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 806: Social Outreach, Discipline & Extra Curricular Activities

Course Objective:
- To allowingstudents to explorestrengthsand talents outside ofacademics.
- Tohelpingstudents developstrongertime-management andorganizationalskills.
- Togivingstudentstheopportunitytobuildfriendships andparticipateingroupactivitiesoutsideof thetight circleof theregular classroom.
- Tohelpingtobuildconfidence andself-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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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
BTBSC 807: ANANDAM

Objectives:
➢ To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
➢ To inculcate the habit of service in students across the University.
➢ A compulsory course of 2 credits per semester to be included in each program of University.

- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

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 ofstudy, 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 inpractical sessions. These sessions provide vital insights into scientific concepts and drawlearner'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 providesgreat 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 learningwhile understanding the practical importance.

6. **Textbooks learning:** A large number of books are included in the list of references of eachcourse for enrichment and enhancement of knowledge.

7. **E-learning:** Learner may also access electronic resources and educational websites for betterunderstanding and updating the concepts.

8. **Self-study materials:** Self-study material provided by the teachers is an integral part oflearning. 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 oftheory 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 activitiesdevoted 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 suchvisits 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 scientificconcepts. 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/institutesprovide 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.

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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 GradePoint 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.

$$\textbf{SGPA} \ (Si) = \Sigma \ (Ci \ x \ Gi) \ / \ \Sigma Ci$$

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Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith 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.

$$CGPA = \Sigma \, (Ci \, x \, Si) / \Sigma \, Ci$$

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-	Semester-	Semester-	Semester-	Semester-	Semester-	Semester-	Semeste

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1	2	3	4	5	6	7	r-8
Credit: 20 SGPA:6.9	Credit: 22 SGPA:7.8	Credit: 25 SGPA:5.6	Credit: 26 SGPA:6.0	Credit: 26 SGPA:6.3	Credit: 25 SGPA:8.0	Credit: 24 SGPA:8.0	Credit: 26 SGPA:8.0

Thus, CGPA= 20x6.9+22x7.8+25x5.6+26x6.0+26x6.3+25x8.0+24x8.0+26x8.0

$$\frac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0 + 24 \times 8.0 + 26 \times 8.0}{194} = \mathbf{7.06}$$

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.

…….******…….