

Course Title:	Elements of Mechanical Engineering	Semester	I/II
Course Code:	BEMEM103 /203	CIE Marks	50
Course Type (Theory/Practical/Integrated)	THEORY	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03
Course Learning Objectives CLO 1. Understand the fundamental concepts of energy; its sources and behavior; its Conversion. CLO 2. Demonstrate the underlying concepts and methods behind IC engines & Modern mobility. CLO 3. Acquire knowledge about power transmission and joining processes. CLO 4. Analyze conventional and advanced manufacturing processes. CLO 5. Discuss the need for Automation & Robotics in manufacturing.			
<u>Teaching-Learning Process :</u> <ol style="list-style-type: none"> 1. Lectures: Traditional & Innovative teaching methods are adopted so that the delivered lectures shall develop student's theoretical and practical skills. 2. Student- faculty interaction: Q & A session, 3. Power point presentation & smart board teaching: Multimedia 4. Activity-based learning: Workshops, seminars, Assignment & Quiz 5. Practical Learning: Hands-on & Demonstration in the lab. 			
Module-1: Energy Conversion System (08 hours)			
Self-study: Additive Manufacturing, AI & ML in Mechanical Industries, Sensors. Introduction to Mechanical Engineering (Overview only): Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors. Steam Formation and Application: Modes of heat transfer, Steam formation, Types of steam, Steam properties and applications of steam (simple numerical). Refrigeration and Air Conditioning: Classification of Refrigeration, Working Principles of Vapor Compression, vapor absorption refrigerator. Properties of Refrigerant, Working principle of Window Air Conditioner. Heating and Ventilation.			

<p>Demonstration & Study: Refrigeration & Airconditioning. Turbines.</p> <p>Application: Boilers, Thermal power plants</p>
<p align="center">Module-2: Modern Mobility and Internal Combustion Engines (8 hours)</p>
<p>Self-study: 2-stroke petrol & Diesel engine</p> <p>Electric vehicles (EV) and Hybrid Electric vehicles (HEV): Basic principles of EV and HEV. Components of EV and HEV – Traction battery pack, DC-DC converter, Electric motor, power inverter, charge port, controller, Transmission. Power transmission in EV and HEV, Types of batteries, Regenerative braking systems, Working principle of fuel Cells</p> <p>Internal combustion Engines: Introduction, Classification, Engine details, Otto and Diesel four strokecycle, Comparison of otto and diesel cycle, Indicated Power , Brake Power, Efficiencies (Elementary Numericals)</p> <p>Demonstration & Study: Two stroke & Four-stroke I.C Engine</p> <p>RBT Levels: L2, L3 and L4</p>
<p align="center">Module-3: Machining & Joining process (08 Hours)</p>
<p>Self-study: Taper turning methods, Capstan & Turret lathe, Electron Beam welding</p> <p>Machine Tool operations: Lathe, engine lathe, specification, major parts; Lathe operations plain turning, taper turning by swiveling compound rest, facing, thread cutting, drilling, knurling. (Sketchesto be used only for explaining the operations).</p> <p>Milling machine – upmilling & downmilling, operations- face milling & end milling</p> <p>Metal Joining Processes: Welding, Classification of welding, Oxyacetylene welding, Arc welding, Electrodes, Resistance Welding - Spot, Seam. Flash welding, Soldering and Brazing</p> <p>Demonstration & Study: Turning, knurling, thread cutting, Arc welding.</p> <p>(RBT Levels: L1, L2 and L3)</p>
<p align="center">Module-4: Power Transmission (08 hours)</p>
<p>Self-study: Rope Drives and Chain drives & its applications, Materials used to manufacture flat Belt & V-belts.</p> <p>Belt drives: Types, Velocity ratio, Slip, Length of belts for Open belt and Cross belt drive, Angle of lap, ratio of belt tensions, Power transmitted, Creep in belt drive, Pulleys; Stepped, Tight</p>

and loose, Idler. Simple numerical.

Gear Drives: Classification of gears, Spur gear nomenclature, Velocity ratio, Rack and Pinion, Helical gears, Bevel gears and Worm gears. Gear Trains: Train values, Classification of gear trains and their uses, Simple numerical problems on simple & Compound gear trains.

Applications: Power transmission between driving & driven Shafts.

Demonstration of driving pulley to driven pulley

(RBT Levels: L2, L3 and L4)

Module-5: Automation & Robotics (8 hours)

Self-study: CNC Programming, Sensors, FMS

Industrial Automation: Types of automation: Fixed, programmable and flexible automation; basic elements with block diagrams; Control systems: open loop and closed loop.

Computer Numerical Control Machines: Numerical control, Computer numerical control and Direct Numerical control.

Robotics: Introduction to Robots, History, Criteria for defining a robot, work volume, robot anatomy, joint configuration, industrial and collaborative robots

Applications: Process Industry, Automotive Industry

Demonstration : Industry visit for demonstration of CNC and Robotics.

(RBT Levels: L2, L3 and L4)

Course outcome (Course Skill Set)

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

CO1: Discuss various energy conversions systems & their principles.

CO2: Articulate the principle & components IC engines and Modern mobility systems

CO3: Analyze various power transmitting devices & Joining Process.

CO4: Identify suitable conventional and advanced manufacturing processes for real world applications.

CO5: Examine & predict the evolution of future technologies in Automation for Manufacturing.

Course Assessment and Evaluation Details (both CIE and SEE)

Continuous Internal Evaluation: 50 marks

Theory Assessment Tool

Marks

Reduced marks

IAT-1

25

25

IAT-2	25	
Assessment -1(activity based)	25	25
Assessment-2(activity based)	25	
Semester End Examination (SEE) : 50 marks		
SEE	Marks	Reduced marks
Course end examination (Answer any one question from each unit – Internal choice)	100	50

Activity-Based Learning / Practical Based learning :

1. Visit to any manufacturing/aero/auto industry or any power plant
2. Demonstration/ Presentation of lathe/milling/drilling/CNC operations
3. Demonstration/Presentation of working of IC engine/refrigerator
4. Demonstration/Presentation of metal joining process
5. Demonstration / Presentation of latest trends in mobility/robotics

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)Text Books

1. Textbook Of Elements Of Mechanical Engineering : by [K R Gopalakrishna](#), [Sudhir Gopalakrishna](#), [H N Girisha](#) (Author), [Subhas Publications / Subhas Stores](#) (Publisher).
2. Elements of Mechanical Engineering. By R.K. Rajput
3. K. P Roy, “Elements of Mechanical Engineering”, Media Promoters & Amp; Publishing Pvt. Ltd, 7thEdition, 2014.

Reference Books

1. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition,16-2-2023.
2. Manufacturing Technology- Foundry, Forming and Welding, P.N.Rao Tata McGraw Hill.
3. Husain, Iqbal, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 3rd Edition, 2021.
4. Robotics, Appu Kuttan KK K. International Pvt Ltd, volume 1

Web links and Video Lectures (e-Resources):**Links:**

1. Mechanical Properties of Engineering materials:

<https://www.youtube.com/watch?v=WSRqJdT2COE&t=83s>.

Oxyacetylene welding: <https://www.youtube.com/watch?v=-SA4D098u-Q>

2. Links: Internal Combustion Engine: <https://www.youtube.com/watch?v=mRcFO7X8yP4>. Links: Electric Vehicle:

<https://www.youtube.com/watch?v=xEOd0JtXVLw>.

3. Links: Refrigeration: <https://youtu.be/PjcdqAkP0UA>

Electron Beam machining: <https://youtu.be/dP2m7-WAdos>.

4. Links: Belt drives: https://www.youtube.com/watch?v=0mb_XMGja_c

5. Gear trains: <https://www.youtube.com/watch?v=tjNsUzxRjfw>

COs and POs Mapping

COs	PO'S											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	0	0	0	2	2	1	0	0	2	2
CO2	3	2	1	0	0	2	2	1	0	0	2	2
CO3	3	2	1	0	2	2	2	0	0	0	3	2
CO4	3	2	0	0	0	2	2	1	0	0	3	2
CO5	3	2	0	0	0	2	2	1	0	0	3	2

Level 3- Highly Mapped,

Level 2-Moderately Mapped,

Level 1-Low Mapped,

Level

0- Not Mapped