

ELEMENTS OF MECHANICAL ENGINEERING

I Year B. Tech. I Semester
(Common to MECH, MECH (R & AI))

Course Code:

L	T	P	C
3	0	2	4

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

CO1: Explain the functions, types and applications of basic machine elements, power transmission systems and fasteners (L2).

CO2: Classify engineering materials, explain mechanical properties and mechanical testing methods (L2).

CO3: Describe basic fundamental concepts of IC engines, refrigeration and air conditioning (L1)

CO4: Explain the basic principles, processes and applications of casting, metal forming, joining and machining (L2).

CO5: Outline the emerging technologies in mechanical engineering (L2).

UNIT-I

10 Lectures

Introduction to mechanical engineering: Materials engineering, thermal engineering, design engineering and manufacturing engineering.

Introduction to machine elements: Shaft, axle, keys, couplings, bearings, clutches, brakes, power transmission elements: belt, rope, chain and gears drives (types only), Fasteners – classification of fasteners, screw thread terminology, forms of screw thread, single and multi-start threads, bolts and nuts.

Learning Outcomes: At the end of this unit, the student will be able to

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| 1. explain functions, types and applications of machine elements | (L2) |
| 2. explain flexible and rigid power transmission elements | (L2) |
| 3. classify and explain fasteners and screw threads | (L2) |

UNIT-II

8 Lectures

Engineering materials and testing: Stress-strain diagram, mechanical properties of materials, materials used in engineering, ferrous metals - cast iron and steel, non-ferrous metals and their alloys. Tensile test, shear test, hardness test and fatigue test.

Learning Outcomes: At the end of this unit, the student will be able to

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| 1. explain basic areas of mechanical engineering | (L2) |
| 2. classify engineering materials and explain their characteristics | (L2) |
| 3. explain mechanical properties and material testing | (L2) |

UNIT – III

10 Lectures

IC engines: Introduction, classification of I.C. engines, I.C. engine-parts and terminology, four and two stroke cycle engines –petrol and diesel, comparison between four and two stroke cycle engines, comparison between petrol and diesel engines.

Refrigeration and air conditioning: Introduction- unit of refrigeration, COP, applications, vapour compression refrigeration system, open air conditioning and closed air conditioning.

Learning Outcomes: At the end of this unit, the student will be able to

1. describe the parts of an IC Engine and differentiate between petrol and diesel engines. (L1)
2. explain the working and differentiate a 2 stroke and a 4stroke engine. (L2)
3. explain the basic fundamentals of refrigeration and air conditioning. (L2)

UNIT-IV

10 Lectures

Manufacturing processes: Metal casting; metal forming processes- rolling, extrusion, forging; metal joining processes: welding, soldering and brazing; metal removal processes: turning, drilling, shaping and milling operations.

Learning Outcomes: At the end of this unit, the student will be able to

1. explain the basics of casting and metal forming processes (L2)
2. explain basics of metal joining processes (L2)
3. describe machining operations and additive manufacturing (L1)

UNIT V

10 Lectures

Emerging technologies in mechanical engineering – Electric vehicles, autonomous vehicles, AI-ML in mechanical engineering, Internet of Things (IoT), smart manufacturing, additive manufacturing (3D printing), robotics and automation, smart materials, digital twins and simulation, space exploration and satellite technology.

Learning Outcomes: At the end of this unit, the student will be able to

1. explain the emerging technologies in mechanical engineering. (L2)
2. explain basic concept of additive manufacturing. (L2)
3. explain the applications of AI-ML in mechanical engineering. (L2)

Note: Examining would be on theory only and excluding derivations and problems.

Text books:

1. Banapurmath N.R. & Yalliwal V.S., *Basic Mechanical Engineering*, Vikas Publishing House Pvt. Ltd, 2016. (Unit I, II)
2. G Shanmugam & S Ravindran, *Basic Mechanical Engineering*, McGraw Hill Education (India) Private Limited, 2024 (Unit III, IV)

References:

- 1) Basant Agarwal, C M Agarwal, *Basic Mechanical Engineering*, Wiley publication, 2008.
- 2) R K Rajput, *Basics of Mechanical Engineering*, 1st Edition Reprint, University Science Press, 2015.
- 3) V. M. Domkundwar, S. S. Bhavikatti, *Basic Mechanical Engineering*, Nirali Prakashan, 2018.
- 4) <https://frontlinesmedia.in/emerging-technologies-future-trends/> (Unit V)

LIST OF EXPERIMENTS

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

CO1: Identify and demonstrate the applications of basic machine elements and power transmission elements (L1)

CO2: Use Vernier caliper and micrometer to measure component dimensions and perform basic material tests such as tensile, shear, and hardness tests. (L3)

CO3: Demonstrate the working principles of refrigeration and air-conditioning (R&AC) system and assemble/disassemble a two-stroke engine (L3)

CO4: Prepare basic engineering components using casting, welding, and machining processes (L3)

CO5: Demonstrate the operation of an RC-controlled mobile robot and Fabricate basic components using 3D printing (L3)

Note: Any twelve of the following experiments are to be performed

1. Measurement of dimensions using Vernier calliper and micrometer
2. Assembly and disassembly of two stroke engine
3. Preparation of a green sand mould using single piece pattern for casting
4. Preparation of a green sand mould with core using split piece pattern for casting
5. Facing and plane turning operation using lathe machine
6. Drilling operation using drilling machine
7. Preparation of butt joint using arc welding
8. Preparation of T-joint using arc welding
9. Assemble of RC controlled mobile robots
10. 3D printing of mechanical components
11. Demonstration of material testing (tensile, shear, and hardness)
12. Demonstration of machine elements (shaft, key, couplings, clutch, brakes, bearings)
13. Demonstration of power transmission elements (belt, rope, chain and gear drives)
14. Demonstration on working of refrigeration and air conditioning system