Code:	**1BEME105/205**	**Course:**	**Elements of Mechanical Engineering**
Credits:	**3**		**L:T:P 3:0:0**
SEE:	**50%**		**CIE: 50%**
SEE Hours:	**3**		**Max. Marks:100**

Prerequisites if any	
Learning objectives	1. Introduce the role of mechanical engineering in technology, industry, and society.
	2. Familiarize students with conventional and emerging energy sources, prime movers, and e-mobility systems.
	3. Provide knowledge of manufacturing processes, machine tools, modern CNC systems, robotics, and additive manufacturing.
	4. Develop fundamental understanding of engineering mechanics concepts such as moment of inertia, dynamics, and kinematics.
	5. Enable students to analyze and apply basic mechanical engineering principles in real-world applications.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Explain the importance of mechanical engineering in various industrial sectors and describe energy sources, prime movers, refrigeration, and e-mobility systems.	Understand
CO2	Illustrate and compare different manufacturing processes, machine tools, CNC systems, additive manufacturing, and robotics applications.	Understand Analyse
CO3	Apply the principles of engineering mechanics (moment of inertia, dynamics, and kinematics) to solve basic mechanical problems.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11		PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	1	2	3	1	-	1	-		2	3	2	1
CO2	3	2	2	2	3	2	2	1	1	2	1		3	2	3	2
CO3	3	3	2	2	2	1	1	-	-	1	-		3	1	3	1

Mapping Strength: **Strong– 3** **Medium – 2** **Low – 1**

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1				
1.1	**Introduction**: Role of Mechanical Engineers in technology & society, Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace and Marine sectors	02	-	-
1.2	**Energy Sources**: Review of energy sources; Conventional (Hydel energy) and non-conventional (photovoltaic cell) energy sources.	02	-	-
1.3	**Prime Movers**: Classification, internal combustion engines: brief description of 4-stroke, petrol & diesel engines: working principle, simple numerical on I.C. engine.	03	-	
Module – 2				
2.1	**Introduction to e-Mobility:** Components of Hybrid & Electric Vehicles, Batteries, Drives & Systems, Advantages & Disadvantages of e-Mobility.	03		
2.2	**Refrigeration & Air-conditioning:** Introduction, Basic Terminology(Refrigerant, condenser, evaporator, compressor, Coefficient of Performance (COP)), Working principle of Vapour Compression conditioning systems	03	-	-
2.3	**Additive Manufacturing:** Definition, History, Basic steps in AM, Comparison between AM & CNC, Advantages and limitations, Applications, Classification on AM technology	03		
Module – 3				
3.1	**Manufacturing processes:** Introduction, classification & applications.	02	-	-
3.2	**Casting:** Principle, sand & die casting procedure, Properties of Moulding sands & die steels, applications.	03	-	-
3.3	**Fundamentals of Machine Tools and Operations:** Fundamentals of Machining and machine tools, Material removal operations: Drilling, Milling & Grinding	03	-	-
Module – 4				
4.1	**Lathe:** Working Principle of a typical lathe, Components of a lathe and operations on a lathe: Turning, facing, and drilling.	02	-	-
4.2	**Introduction to Modern Manufacturing Tools:** CNC: Introduction, components of CNC, advantages and applications of CNC, CNC Machining Centres and Turning Centres. Comparison of conventional & CNC Lathes.	03	-	-
4.3	**Robotics:** Robot anatomy, Joints & links, common Robot configurations. Applications of Robotics in Material Handling, Processing, Assembly and Inspection. Concepts of Smart Manufacturing and Industrial IoT.	03	-	-
Module – 5				
5.1	**Moment of inertia-** Definition, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem.	03	-	-
5.2	**Basics of Dynamics** – Basic Concepts (Space, Time, mass, force, gravitation), Newton's laws, velocity and acceleration.	02	-	-
5.3	**Kinematics:** Particle motion, rectilinear motion, plane curvilinear motion, relative motion and constrained motion.	03	-	-
Total No. of Lecture Hours		**40**		
Total No. of Tutorial Hours			**00**	
Total No. of Practical Hours				**00**

Textbooks:

1. Elements of Mechanical Engineering by K.P. Roy, S K Hajra Choudhury, A K Hajra Choudhury, Media Promoters, 2016.
2. An Introduction to Mechanical Engineering by Jonathan Wickert, Kemper Lewis, Cengage Learning, 2017, 4th Edition.
3. Pham D.T. & Dimov S.S "Rapid Manufacturing" Springer London 2011.
4. Introduction to Robotics Analysis, Systems, Applications by Saeed B. Niku, Prentice Hall, 2001.
5. Bhavikatti S S, Engineering Mechanics, 2019, New Age International

Reference Books:

1. Elements of Mechanical Engineering by K R Gopalakrishna, Subhash Publishers, Bangalore, 2018.

2. Workshop Technology, Vol I & II, - by SK Hajra Choudhury, A K Hajra Choudhury, Nirjhar Roy, 11th edition 2001, Media Promotors and Publishers, Mumbai.

3. Timoshenko S, Young D. H., Rao J. V., Engineering Mechanics, 5th Edition, 2017, Pearson Press.