Course Title:	**Introduction to Mechanical Engineering**	Semester	1st /2nd
Course Code:	**BESCK104D / 204D**	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 the conventional and advanced manufacturing processes.
CLO 5. Discuss the need for Automation & Robotics in manufacturing.

Teaching-Learning Process

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 (8 hours)

Renewable energy sources: Solar power: principle of conversion, flat plate collector, Wind energy: conversion, windmill and Hydro power: hydro power station.

Refrigeration & Air-conditioning: Principle of refrigeration, refrigerants and its properties, parts of refrigerator, terms used in refrigeration system, principle and working of vapour compression & Vapour absorption refrigerator, room air conditioner.

Self-study: Condenser, compressor, expansion valve

Applications: split & centralized air conditioning system

(RBT Levels: L2 and L3)

Module-2: Modern Mobility (08 hours)

Electric vehicles (EV) and Hybrid Electric vehicles (HEV): Basic principles of EV and HEV. Components of EV and HEV, DC DC Converter, Batteries, Charging Port, Power transmission

in EV and HEV.

Internal combustion Engines: Introduction, Classification, Engine details, Otto and Diesel four stroke cycle, Comparison of otto and diesel cycle, Indicated Power , Brake Power, Efficiencies (Elementary Numerical)

Demonstration & Study: Two stroke & Four-stroke I.C Engine

Self-study: 2-stroke petrol & Diesel engine

Applications: Automobile, Generators

(RBT Levels: L2, L3 and L4)

Module-3: Power Transmission & Joining Process (08 hours)

Power Transmission: Belt Drives - Open and cross belt-drives, pulleys and its types, velocity ratio of pulleys, creep and slip in the belts, derivation for length of belt. Gear Drives: Types of gear drives, advantages and disadvantages of gear drives over belt drives. Gear Trains- Simple & Compound Gear trains, Simple numerical.

Welding, Brazing and Soldering: Introduction of welding- Arc welding, TIG & MIG Welding Process, Brazing and Soldering - Principle, Comparison of welding, brazing and soldering.

Self-study: V-belts-applications, materials used in manufacturing, welding electrode-consumable & non consumable

applications: Fabrication Industries,

(RBT Levels: L2, L3 and L4)

Module-4 : Machine Tools (08 hours)

Lathe - Engine lathe, specification, major parts; Lathe operations: plain turning, taper turning by swiveling compound rest, facing, thread cutting, drilling, knurling. (Sketches to be used only for explaining the operations) Milling machine – upmilling & downmilling, operations-face milling & end milling

Computer Numerical Control (CNC) machines: Elements of a CNC system, salient features of CNC controls, advantages and disadvantages of CNC.

Self-study: L a t h e - Types of taper turning, CNC machining- G-codes, M-codes,

Applications: Turning, cutting, taper turning, knurling

(RBT Levels: L2 and L3)

Module-5: Automation & Robotics (8 hours)

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

Robotics: Elements of robotic system, type of robotic joints; robotics configuration: polar, cylindrical, cartesian, SCARA & Articulate. Applications of robots- material handling, process operation and assembly & inspection, advantages and disadvantages of industrial robotics.

Self-study: AGV's & driving mechanisms, applications.

Applications: Process Industries, Automotive Industries

(RBT Levels: L2, L3 and L4)

Course Outcome

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. Activity: Chart preparation- operations in lathe
2. Modern tool usage: Use of CADEM software for CNC milling & Turning operation.
3. Lab Exercise: Demonstration of Turbine working principle.

4. Group Activity: Quiz & Seminar on Renewable energy sources & modern mobility (on any one topic not covered in syllabus)

Suggested Learning Resources:

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

1) Textbook Of Elements Of Mechanical Engineering : by Kr Gopalakrishna, Sudhir Gopalakrishna, Hn 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, 7th Edition, 2014.

Reference Books

1) S. Trymbaka Murthy, "Text book of Elements of Mechanical Engineering", MEDTECH, Scientific International Pvt Ltd, 1st Edition, 2019.
2) Husain, Iqbal, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 3rd Edition, 2021.
3) Arshdeep Bahga, Vijay Madisetti, "Internet of Things a Hands-on Approach", Hyderabad Universities Press, 2020.
4) Dr. A. S. Ravindra, "Elements of Mechanical Engineering", Best Publications, 7th Edition, 2009.

Web links and Video Lectures (e-Resources):

1) Links: Refrigeration: https://youtu.be/PjcdqAkP0UA
2) Links: Electric Vehicle: https://www.youtube.com/watch?v=xE0d0JtXVLw
3) Oxyacetylene welding: https://www.youtube.com/watch?v=-SA4D098u-Q.j
4) Links: Belt drives: https://www.youtube.com/watch?v=0mb_XMGja_c
   Gear trains : https://www.youtube.com/watch?v=tjNsUzxRjfw

COs and POs Mapping (CO-PO mappings are only **Indicative)**

COs	POs											
	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