BME101 / BME201: FUNDAMENTALS OF MECHANICAL ENGINEERING

Content	Contact Hours
Unit -1: Introduction to Mechanics	8
Force moment and couple, principle of transmissibility, Varignon's theorem. Resultant of force system- concurrent and non-concurrent coplanar forces, Types of supports (Hinge, Roller) and loads (Point, UDL, UVL), free body diagram, equilibrium equations and Support Reactions. Normal and shear Stress, strain, Hookes' law, Poisson's ratio, elastic constants and their relationship, stress-strain diagram for ductile and brittle materials, factor of safety.	
Unit-2: Introduction to IC Engines and Electric Vehicles	8
IC Engine: Basic definition of engine and Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits, scavenging process; difference between two-stroke and four stroke IC engines and SI and CI Engines. **Electric vehicles and hybrid vehicles:** Components of an EV, EV batteries, chargers, drives, transmission and power devices. Advantages and disadvantages of EVs. Hybrid electric vehicles, HEV drive train components, advantages of HV.	
Unit-3: Introduction to Refrigeration and Air-Conditioning	8
Refrigeration: Refrigerating effect, Ton of Refrigeration; Coefficient of performance, methods of refrigeration, construction and working of domestic refrigerator, concept of heat pump. **Air-Conditioning:** Its meaning and application, humidity, dry bulb, wet bulb, and dew point temperatures, comfort conditions, construction and working of window air conditioner.	
Unit-4: Introduction to Fluid Mechanics and Applications	8
Introduction: Fluids properties, pressure, density, dynamic and kinematic viscosity, specific gravity, Newtonian and Non-Newtonian fluid, Pascal's Law and Continuity Equation. Working principles of hydraulic turbines (Pelton Wheel and Francis)& pumps (Centrifugal and Reciprocating) and their classifications and hydraulic lift.	
Unit-5: Introduction to Measurement and Mechatronics	12
Introduction to Measurement: Concept of Measurement, Error in measurements, Calibration, measurements of pressure(Bourdon Tube Pressure and U-Tube Manometer), temperature(Thermocouple and Optical Pyrometer), mass flow rate(Venturi Meter and Orifice Meter), strain(Bonded and Unbonded Strain Gauge), force (Proving Ring) and torques(Prony Brake Dynamometer); Concepts of accuracy, precision and resolution. **Introduction to Mechatronic Systems:** Evolution, Scope, Advantages and disadvantages of Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics, and avionics and their applications. Sensors and Transducers: Types of sensors, types of transducers and their characteristics.	

Overview of Mechanical Actuation System – Kinematic Chains, Cam, Ratchet Mechanism, Gears and its type, Belt, Bearing. **Hydraulic and Pneumatic Actuation Systems:** Overview: Pressure Control Valves, Direction Control Valves, Rotary Actuators, Accumulators and Pneumatic Sequencing Problems.	

Course Outcomes:

The students will be able to		Blooms Level
CO1	Apply the concept of force resolution and stress and strain to solve basic problems	K3
CO2	Understand the construction details and working of internal combustion engines, electric vehicle and hybrid vehicles.	K2
CO3	Explain the construction detail and working of refrigerator, heat pump and air-conditioner.	K2
CO4	Understand fluid properties, conservation laws and hydraulic machinery used in real life.	K2
CO5	Understand the working principle of different measuring instrument and mechatronics with their advantages, scope and Industrial application.	K2

Reference Books:

1. Basic Mechanical Engineering, G Shanmugam, S Ravindran, McGraw Hill
2. Basic Mechanical Engineering, M P Poonia and S C Sharma, Khanna Publishers
3. Mechatronics : Principles, Concepts and Applications, Nitaigour Mahalik, McGraw Hill
4. Mechatronics, As per AICTE: Integrated Mechanical Electronic Systems, K.P. Ramachandran, G.K. Vijayaraghavan, M.S.Balasundaram, Wiley India
5. Mechanical Measurements & Control, Dr. D. S. Kumar. Metropolitan Book Company
6. Fluid Mechanics and Hydraulic Machines, Mahesh Kumar, Pearson India