



**DEPARTMENT OF MECHANICAL ENGINEERING**  
**PhD Syllabus for Entrance Examination Jan 2024**

**Materials and Manufacturing:** Fe-Fe<sub>3</sub>C Equilibrium Diagram, and Heat Treatment of Steel, Characterization of Materials, Powder Metallurgy, and Corrosion Degradation of Materials. Brief about Basic Manufacturing & Advanced Manufacturing Processes

**Mechanics of Materials:** Review of Statics – Stress and strain fundamentals – Stress strain diagram – Hooke’s Law & poisson ratio - Elastic Constants – Thermal Stress- Types of beams – types of loadings -Theory of simple bending – Deflection of beams –Thin and Thick wall cylinders – Friction & its applications – Helical & leaf springs – Torsion of solid and hollow shaft

**Design Thinking Overview** - Design Thinking Skills - Principles of design thinking – Exercises Design Thinking approaches in stages – Empathize – Define- Ideate – Prototype-test Design thinking Techniques - Listening and Empathizing Techniques- engagement-observation-empathizing - Define and Ideation Techniques- Unpacking -Personas- pattern recognition -Prototype and Test Techniques- types and forms of testing - Story Telling Techniques

**Essentials of Fluid Mechanics & Heat Transfer:** Fluid properties, Fluid Flow measurements, laminar and turbulent flows. Hydrostatics: Buoyancy, forces on submerged bodies. Flow through pipe. Concepts of CFD Modes of heat transfer. Steady state conduction, Transient state conduction, forced convection, Free convection. Heat exchangers (Parallel flow & Counter flow)

**Concepts of Thermal Engineering:** Thermodynamics Laws, Importance of Second law of thermodynamics, Availability for flow and non-flow system, Overview of Thermodynamic cycles. Concepts related to solar energy harvesting.

**Energy and Sustainability:** Global climate change: economics, science and policy — electrochemical energy systems - Fuel Cells -Batteries, Life Cycle Assessment (Battery) Sustainable buildings in developing countries - Energy footprints -Carbon footprints.

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