MTPE3001 ALTERNATIVE ROUTS OF IRON MAKING (3-0-0)

Course Objectives

To explore and analyze alternative iron-making processes beyond traditional blast furnaces, focusing on direct reduction, smelting reduction, and other innovative technologies. The course emphasizes comparative evaluation of these methods in terms of efficiency, environmental impact, and economic viability to prepare students for modern iron production challenges.

1. Tensile Testing of Different Materials (Aluminum/ Brass/ Cast Iron)
   Compare mechanical properties across different material classes and understand the effect of microstructure on tensile behavior.
2. Compression Test on Metal Specimens
   Study compressive strength, modulus of elasticity in compression, and failure modes.
3. Wear testing of ferrous materials
   Determination of wear resistance of mild steel / low carbon steel in dry condition.
4. Wear testing of non-ferrous materials
   Determination of wear resistance of aluminium / copper / brass in dry condition.
5. Fatigue Testing (Rotating Beam Method)
   Study S-N curve generation and determine fatigue limit. Understand crack initiation and propagation under cyclic loading.
6. Creep Test at Elevated Temperature
   Measure time-dependent deformation under constant load. Understand primary, secondary, and tertiary creep stages.
7. Fracture behaviour of materials
   Generate ductile and brittle failure and define their toughness.
8. Scanning Electron Microscopy (SEM)
   Study its application in analysing fracture behaviour.
9. Crack Propagation Study
   Observe crack growth using optical methods or strain gauges.
10. Elastic Modulus Measurement by Ultrasonic Method
    Non-destructive determination of elastic constants using wave velocity measurements. Compare with static testing results.
11. Poisson's Ratio Determination
    Measure lateral and axial strains during tensile testing. Calculate Poisson's ratio and understand volume change behaviour.

Course Outcomes:

CO1: Explain the principles and limitations of conventional blast furnace iron-making versus alternative routes. (Understanding)
CO2: Compare direct reduction (e.g., MIDREX, HYL) and smelting reduction (e.g., COREX, FINEX) processes in terms of energy consumption and emissions. (Analysis)
CO3: Evaluate the role of raw materials (e.g., iron ore pellets, coal, natural gas) in different iron-making technologies. (Evaluation)
CO4: Assess the environmental and economic impacts of alternative iron-making methods. (Evaluation)
CO5: Propose suitable iron-making routes for specific industrial scenarios based on technical and sustainability criteria. (Creation)