Syllabus: Materials and Metallurgical Engineering

Extractive Metallurgy

Fuels characterization, Secondary fuel, Combustion, Refractory and Furnaces Design, Role of Unit Processes in Metal Extraction, Pyrometallurgical Processes, Hydrometallurgical Processes, Electrometallurgical processes, Thermodynamics.

Computational Material Science

First-principles density functional theory, molecular dynamics, Monte Carlo simulation and phase- field method, Atomistic theory of matter – from electrons to interaction potentials, Statistical mechanics of materials: equilibrium and non-equilibrium systems and ensembles, Coarse graining methods, Continuum models of materials and microstructures, Numerical heat transfer and fluid flow.

Mechanical Metallurgy

Concepts of stresses and strains, elasticity theory, plasticity, deformationmechanisms, dislocation theory, critical resolved shear stress deformation of poly-crystals, hardening mechanisms, grain size effect, fracture mechanics, fatigue, creep, Mechanical processing of metal.