

Mineral Processing & Principles of Extractive Metallurgy

(No. of Credits: 4)

Syllabus:

Unit-I: Introduction: Scope and objectives of ore dressing. Ore sampling. Comminution: Theory of liberation of minerals. Crushers: -Jaw, Gyratory, Cone, Rolls and toothed roll crushers, Types of grinding operations like batch and continuous dry and wet grinding, open circuit and closed circuit grinding. Grinding Mills: Critical Velocity, Ball mills, Rod mills, tube mills and Stirred mills. Comminution laws: - Rittinger's laws, Kick's law and Bond's law.

Unit-II: Sizing and Screening: Sizing: Study of laboratory sizing techniques and reporting of sizing data. Industrial sizing units: Types of screen surfaces. Grizzlies, trommels, vibrating and shaking screens. Classification: Movement of solids in fluids: Stokes and Newton's laws, Terminal velocity and its relation with size, Relation between time and velocity, Relation between distance traveled and velocity, Equal settling ratio, Free and hindered settling ratios, Quantifying concentrating operations: Ratio of concentration, recovery, selectivity index and economic recovery. Classification of classifiers, study of settling cones, rake classifier, spiral classifier and cyclones

Unit-III: Concentration I: Heavy media separation: Principles, flow chart, different media used, Heavy media separation using heavy liquids and heavy suspensions, Washability curves for easy, normal and difficult coal, Jigging: Theory of jigging. Jigging machines: hand jig, harz jig, denver jig baum jig, Hancock jig, James coal jig and halkyn jig, Design considerations in a jig, Tabling: - study of stratification on a table, Shaking tables, wilfley table. Humphrey's spiral classifier.

Unit-IV: Concentration I: Flotation: Principles of flotation. Factors affecting flotation, Classification of collectors and frothers, Regulators factors affecting their efficiency, Flotation machines: -Pneumatic and mechanical flotation cells, Application of flotation process for Cu, Pb and Zn ores.

Unit-V: Concentration II and Dewatering: Magnetic separation processes and electrostatic separation process; Dewatering techniques.

Unit-V: Principles of extractive metallurgy: Pyrometallurgy: Principles of roasting and smelting, Hydrometallurgy: Principles of leaching, types of leaching, Properties of leaching solutions. Electrometallurgy: Principles of electrowinning and electrorefining. Types of electrolytes: Aqueous and non-aqueous electrolytes. Refining: Principles of refining. Different methods of refining.

Resources:

(1) Books: (i) A.M. Gaudin, Principles of Mineral Dressing, (ii) 2. A. Wills, Mineral processing technology, (iii) A.F. Taggart, Elements of Ore Dressing, (iv) T Rosenqvist, Principles of Extractive Metallurgy, (v) A Ghosh, H S Ray, Principles of Extractive Metallurgy, (vi) Fathi Habashi Principles of Extractive Metallurgy – Vol-I.