



Introduction to Mineral Processing

Mining Engineering

Instructor Name: Prof. Arun Kumar Majumder

Institute: IIT Kharagpur

Department: Metallurgy and Material Science

About Instructor: Arun Kumar Majumder is an Associate Professor in the Department of Mining Engineering of IIT Kharagpur. He is a PhD in Mineral Processing from the University of Queensland, Australia. Prior to joining the Department of Mining Engineering at IIT, Kharagpur in 2010, he had served AMPRI (CSIR), Bhopal since 1990 at various levels. He has carried out extensive and in-depth modeling work on complex coal and mineral processing unit operations. These models are developed based on sound fundamental concepts and they have strong industrial relevance too. The most significant aspect of his work is the identification of many problems at their roots first and then providing solutions elegantly. He has set up a new mineral engineering laboratory at IIT, Kharagpur with financial supports from industries. He is in the editorial boards of three international journals, has authored one book, has more than hundred publications and is currently the reviewer of many international journals of repute. He has filed one international and one Indian patent as of now. In recognition of his contributions in the areas of coal and mineral processing, various professional bodies have honored him with 12 awards so far.

Pre Requisites: : +2 Science

Core/Elective: : Core_Elective

UG/PG: : Both

Industry Support : Tentatively all mining companies like NMDC, CIL, SAIL, IREL, UCIL, HZL, HCL, GMDC, APMDC, MPSMC, RSMML, HINDALCO etc. and equipment manufacturing companies like Weir Minerals, Tega Industries, METSO, FL-Smidth, AllMineralsetc.

Course Intro: : Mineral processing is the first process that most ores undergo after mining in order to provide a more concentrated material for the procedures of extractive metallurgy. Although the primary operations are comminution and concentration, but there are other important operations in a modern mineral processing plant, including sizing, sampling and bulk material handling. This course is intended to provide a detailed understanding of the afore-mentioned operations.

COURSE PLAN

SL.NO	Week	Module Name
1	1	Importance of Mineral Processing (Definition of Minerals and Ores, Grade-Recovery Curve, Metallurgical Efficiency vs Economic Efficiency, Numerical Examples) Sampling (Fundamentals, Industrial Practices, Laboratory Practices, Error Estimations)
2	2	Particle Characterization (Various definitions of particle size and density, size distributions and their measurement, distribution curves, numerical examples)



3	3	Comminution 1 (Fundamentals of Rock Breakage, Energy Estimations, Liberation, Reduction Ratio, Primary Crushers, Secondary Crushers, Circuits, Selection Criterion)
4	4	Comminution 2 (Grinding Mills, Critical Speed, Recent Developments) & Mass Balancing (Importance, Techniques, Numerical Examples and their Relevance)
5	5	Industrial Screening (Applications, Basic Design Features, Types of Screens, Performance Evaluation and Factors Affecting Performance)
6	6	Movement of Solids in Fluids ((Equation of Motion, Drag Curve, Free & Hindered Terminal Settling Velocities in Gravitational and Centrifugal Force Fields, Applications)&Classifiers (Various Types and Their Applications)
7	7	Hydrocyclone (Principles of Operation, Design Variables, Operating Variables, Performance Evaluation of Hydrocyclone, Control of Cyclone Operation, Recent Developments) & Closed-Circuit Grinding (Control of Over grinding, Circulating Load Calculation, Comminution Circuit Design)
8	8	Gravity Concentration (Fundamentals, Flowing Film Type, Static Bath Type, Jigging, Centrifugal & Enhanced Gravity Type Concentrators)
9	9	Flotation (Fundamentals, Role of Reagents, Flotation Machines, Typical Applications)
10	10	Bulk Material Storage and Handling (Properties of Bulk Solids, Measurements, Storage, Flow Modes, Silos, Bins and Hopper Design, Common Problems)
11	11	Slurry Transportation (Pipe Line Flow, Mixture properties, Design perspective, Influence of several factors, Basic calculations, Case studies)



12	12	Slurry Transportation (Pipe Line Flow, Mixture properties, Design perspective, Influence of several factors, Basic calculations, Case studies)
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