COMPUTATIONAL TECHNIQUES AND MODELLING

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	FMD461	Computational techniques and modelling	3	0	0	9

Course Objective

The objective of the course is to make the students aware of different approaches to be adopted for metallurgical accounting and computation of operational performances of Mineral processing plants and to know about the mathematical tools to be adopted for developing models for different operations/equipment and their application

Learning Outcomes

Upon successful completion of this course, students will

- have a broad understanding of the approaches for carrying out material balancing of solid, water and slurries in two product separation systems.
- the subject will give an insight on to the operating performances of size separation and beneficiation units
- upon learning, the student will become conversant with minimization of errors involved in estimation of product yield and component recoveries after processing.
- the subject will also make the students to become familiar of the different the optimization techniques to be adopted in operating plants.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction, types of computations and methodologies.	5	Introduction to material balancing and other calculations
2	Mass balancing of complex beneficiation circuits, concept of connection matrix its main applications including component balancing; its uses and advantages, with examples from Pb-Zn, iron ore, coal and beach sands	5	Difficulties faced in mass balancing of complex circuits and the constraints faced in operating plants besides making them to compute minimum number of streams to be sampled to perform mass balancing.
3	Reconciliation of excess data for minimization of errors involved in yield and recovery calculations.	5	Helps to understand how to optimize product yield and recoveries,
4	Statistically aided computation of errors involved in size and chemical analysis of feed and product streams for estimation of accurate yield in the plant operations Application of Lagrangian Multipliers to correct errors in assay values feed, concentrate and tailing streams	6	This will help student in estimating the extent of uncertainties and ranges in which the fluctuation can takes place in the data analysis and knowledge of the corrections can be made assay values of the components considered
5	Introduction to mathematical modelling, Types of models, their relative merits and demerits. Description on empirical and semi empirical models.	6	This will help in understanding of different techniques to be adopted for development of mathematical models in processing coal and mineral processing.
6	Modelling of size reduction processes, use of Matrix modelling for crushers and application of kinetic models and grinding mills. Description and application of Breakage, Selection Function and classification functions, numerical examples for computing product distribution using different models. Mathematical models for different processing equipment and for partition curves	5	This unit will help the student the approach of adoption of matrix modelling for comminution units considering size distribution information of feed and products and the extent breakage took place during comminution.
7	Modelling of Flotation operations for batch and continuous flotation. Kinetic approaches, different	5	Helps to understand the kinetic behavior of the process and through kinetics rate

	kinetic models, estimation of order of equation. Scale-up models for continuous flotation using mechanical cells. Use of kinetic models for design of flotation circuits.		of flotability and based on flotability the size of flotation circuit and size of the cell required.,
8	Population balance models; Discrete Element Modelling	5	Familiarization with population balance modelling and discrete element modelling
	Total	42	

Text Books:

S. No.	Resource/Book Name	Author(s)/Editor(s)	Publisher
1	Modeling and Simulation of Mineral Processing Systems	R. P. King	Butterworth-Heinemann

Reference Books:

S. No.	Resource/Book Name	Author(s)/Editor(s)	Publisher
1	Introduction to Mineral Processing	Errol G. Kelly, David J. Spottiswood	John Wiley and Sons
2	Wills' Mineral Processing Technology	Barry A. Wills James Finch	Society for Mining, Metallurgy and Exploration
3	Principles of Mineral Dressing	Antoine Marc Gaudin	McGraw Hill