COURSE TYPE	COURSE CODE	NAME OF THE COURSE	L	T	P	CREDIT
DC	NFMC509	Modeling of Mineral Processing Systems	3	1	0	4

COURSE OBJECTIVE
To provide an understanding of modeling strategies and techniques used in mineral processing unit operations, equipping students with the skills to implement existing models effectively and develop new models to optimize the utilization of these unit operations.
LEARNING OUTCOMES
At the end of this course, the students will learn about the • Distribution functions and their application in mineral processing systems • Existing models for comminution, size classification, gravity separation, flotation and dewatering processes • Application aspects of these models in mineral processing unit operations and flowsheet designing

NO.	TOPICS TO BE COVERED	LECTURE HOURS	TUTORIAL HOURS	LEARNING OUTCOME
1	**Particle population and distribution functions:** Empirical distribution functions, distribution density functions, representative size, population averages, joint and conditional distribution functions, population balance modeling method, fundamental population balance equation, general population balance equation for comminution machines.	6	3	Understanding of particle distribution functions and models and population balance models
2	**Comminution operations:** Particle fracture energy and breakage probability, breakage functions, modeling of crushers, crushing mechanisms and product size distribution, power drawn models in grinding circuits	6	2	Knowledge of basic concepts of the comminution process and its implementation in modeling comminution circuits
3	**Size classification:** Models for screen efficiency – models based on screen capacity, screen transmission efficiency, kinetic models for screens,	6	2	Familiarization with the screen efficiency models and the hydrocyclones models for

	settling velocity models, size classification function, performance modeling of hydrocyclone			performance analysis
4	**Gravity Separation:** Quantitative models for dense media separators, quantitative models for stratification, performance modeling of two-staged and three-staged jigs, generalized partition function models for gravity separation units	6	2	Knowledge of the models and modeling strategies used for the gravity separation equipment
5	**Flotation:** Kinetic approach to flotation modeling, kinetic models for flotation, distributed rate constant kinetic model for flotation, bubble loading during flotation, particle bubble collision, model for collision efficiencies, bubble loading during flotation, particle detachment and froth phase, simplified kinetic models	6	2	Understanding of the flotation kinetics, models for the flotation process, and application of these models for process optimization
6	**Dewatering and flocculation:** Thickening, models for sedimentation velocity, models for dewatering screens, mechanical dewatering of slurries, filtration models Flocculation kinetics, mathematical models for flocculation, empirical equations, population balance models, particle-polymer interaction modeling	6	2	Knowledge of the models for thickeners and filtration unit
7	**Magnetic separation:** Hopstock model for dry low-intensity magnetic separators, empirical models for capacity estimation, models for forces acting on particles in a magnetic field	6	1	Familiarization with the models for the magnetic separation process and understanding of integration of the models in a plant

	Flowsheet structure: Numerical analysis of simulation, Single unit operations and simple flowsheets, integrated flowsheets			flowsheet and its application in simulating the mineral processing systems
	Total	**42 + 14 = 56**		

TEXT BOOKS:

1. Modeling and simulation of mineral processing systems by R.P. King, SME
2. Mineral processing design and operations by A. Gupta and D. Yan, Elsevier

REFERENCE BOOKS:

1. Principles of mineral processing by Maurice C. Fuerstenau and Kenneth N. Han, SME
2. Introduction to mineral processing by E. G. Kelly and D. J. Spottiswood, John Wiley & Sons