PHYSICAL SEPARATION PROCESSES FOR COAL AND MINERALS

Course Type	Course Code	Name of Course	L	T	P	Credits
DC	FMC203	Physical separation processes for coal and minerals	3	0	0	9

Course Objective
To learn about the principles, construction and operation of physical separation processes
Learning Outcomes
Upon successful completion of this course, students will have the ● knowledge of the need, scope and applications of density separation ● understanding of the basic principles of density separation ● familiarization with the different techniques used for the density separation of coal and minerals ● knowledge of the important factors that affect the performance of industrial density separation technologies ● knowledge about the performance assessment of density separators and their benchmarking

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcomes
1	**Introduction to physical separation processes:** Basic Principles of Separation Processes; different types of processes employed in mineral engineering: density, magnetic, electrical, surface, optical separations. coal/ore characteristics required for applying these processes. Calculations of yield, recovery, ratio of concentration, enrichment ratio and separation efficiency.	3	Introduction to the subject, the different concentration techniques and their scopes, applications and limitations. Introduction to the basic terminology related to concentration, general calculations related to concentration
2	**Washability analysis:** Sink-float test-work for coal and minerals and data interpretation.	6	Knowledge of the washability analysis test-work
3	**Jigging:** Principles of jigging including the major phenomena, equal settling/jigging particles, v-t curves, jig cycles and their applications, different types of jigs-mechanical and pneumatic jigs their merit and demerits, variables affecting jigging	5	Knowledge of the applications and basic principles involving industrial jigging, its operation and performance optimization
4	**Dense medium separation:** Principles of dense medium separation, stability of media suspension, preparation of dense medium, types of solids and their properties to use as dense medium. Factors affecting dense medium stability and consistency. Different types of static and dynamic separators e.g., Dense Medium Baths (deep and shallow) and Dense Medium Cyclones, Vorsyl Separator, Tri-flo separator etc., typical media preparation and media recovery equipment and circuits	7	Awareness of the different dense medium separation techniques and their application, construction, operation and performance determining factors. Knowledge of the need of a medium recovery circuit and its general layout
5	**Stub-cyclones, Teetered Bed Separators, Reflux Classifiers:** Construction, operation and applications. **Flowing film concentration:** Principles. Tabling, influence of various factors affecting tabling, mathematical analysis, different types of tables. Spiral concentration, application of spiral concentrators, Reichert's cone	5	Familiarization with the different techniques used for the gravity concentration of intermediate size particles, with their construction, operation and performance optimization
7	**Enhanced gravity concentration:** Different gravity concentrators like multi-gravity separator, Knelson concentrator, Kelsey jig, Falcon separator etc.	2	Knowledge of the gravity separation techniques applied for the concentration of fine particles

8	**Performance analysis of density separators:** Estimation of cleaning performance, calculation of performance parameters: cut-density, E_P, Error area, imperfection organic efficiency, ash reduction factor, yield reduction factor, etc.	3	Comprehension of the procedure applied for the performance assessment of density separators and interpretation of the results
9	**Magnetic Separation:** Principles of magnetic separation, types of magnetic materials; construction, operation and performance factors of different magnetic separators; typical applications	7	Learning of the principles, construction, operation and important factors for magnetic separation equipment
10	**Electrical Separation:** Principles of electrostatic separation. Electrical properties of materials. Lifting and pinning effect, corona discharge. Construction, operation and performance factors of different electrical separators. Auxiliary equipment. Multi roll separator, plate and screen separators, ESP, tribo-electric separator	4	Understanding the principles of electrical separation and knowledge of the construction, operation and important factors of electrical separators
	Total	42	

Text Books:

S. No.	Resource/Book Name	Author(s)/Editor(s)	Publisher
1	Wills' Mineral Processing Technology	Barry A. Wills James Finch	Butterworth-Heinemann
2	Coal Preparation	Joseph W. Leonard III	Society for Mining, Metallurgy and Exploration

Reference Books:

S. No.	Resource/Book Name	Author(s)/Editor(s)	Publisher
1	Mineral Processing Design and Operation: An Introduction	A. Gupta and D.S. Yan	Elsevier
2	Introduction to Mineral Processing	Errol G. Kelly, David J. Spottiswood	Wiley
3	Gravity Concentration Technology (Developments in Mineral Processing, 5)	Richard O. Burt, Chris Mills	Elsevier