

# MINERAL BENEFICIATION

## Objective

With the progressive depletion of the high grade mineral deposits and the corresponding lowering of the cut of grades for mining, it is desirable that the mining engineers should be familiar with the beneficiation methods. This course aims at such a familiarization so as to enable the graduate mining engineers to supervise the beneficiation plants attached to the mines.

## Module I                    12 hours

Size analysis of minerals. Laboratory sizing. Testing sieves of Indian standards and other standards used internationally such as BSS, Tyler series, ASTM sieves and IMM series. Differential and cumulative size distributions and plots. Size distribution equations. Industrial screens: their design, selection and operations. Sub sieve sizing. Newton's and Stoke's laws for settling of particles. Free and hindered settling. Design, selection and operation of hydraulic and mechanical classifiers such as Akin's spiral Classifier, Dorr rake classifier, rake and bowl classifier etc. Hydro cyclones and Pneumatic cyclones used for classification of minerals. Partition value curves for screens and classifiers.

## Module II                    12 hours

Liberation studies and their importance. Role of size reduction in mineral beneficiation. Operational features of different types of crushers such as jaw, gyratory, cone and short head cone crushers, rotary breakers, roll crushers, hammer mills and stamp mills. Principles of tumbling mills. Construction, selection and operation of pebble mills, rod mills and ball mills including tube mills and Hardginge mills. Autogenous and semiautogenous grinding. Kick's, Ritinger's and Bond's laws on energy requirements for size reduction. Open circuit and closed circuit operations in size reduction. Effects of circulating loads.

## Module III                    12 hours

Principles of density separation of minerals. Dense media separators, dense media cyclones, different types of jigs, spiral concentrators, vibrating tables, cone and tray concentrators, pans, corduories and winnows for mineral concentration. Electrical separation in High Tension rolls, plate and screen plate separators. Different types of dry and wet magnetic separators of low, medium and high intensity. Overview of the surface phenomena and froth flotation of minerals. Rougher, scavenger, cleaner and recleaner operations in mineral beneficiation processes. Dewatering and drying: thickening and filtration.

### Text Books:

1. Mineral Processing Technology by B. A. Wills and T. N. Munn - Elsevier 2006
2. Principles of Mineral Dressing by A.M.Gaudin - McCraw-Hill, 1957
3. Mineral Processing Design and Operation by A.Gupta and D.S.Yan - Elsevier 2006
4. Ore Dressing by R.H.Richards (4 volumes) – Engineering & Mining Journal 1909
5. Ore Dressing Principles and Practice by T.Simon – McGraw Hill Co., 1924
6. A Text Book of Ore Dressing by S.J.Truscott – London Macmillan. 1923

### References:

1. Handbook of Ore Dressing by A.F.Taggart - John Wiley and Sons, New York. 1956
2. Handbook of Ore Dressing by A.W.Allen – McGraw Hill Co., 1920
3. Complete Technology Book on Mineral Processing by NPSC Board – Asia Pacific Business Press 2008