Course No	Course Name	L-T-P- Credits	Year of Introduction
CH203	PARTICLE TECHNOLOGY	3-1-0-4	2016

Prerequisite : Nil

Course Objectives

1. To impart the knowledge of mechanical operations employed in process industries
2. To develop understanding about size analysis, size reduction and solid handling adopted in process industries

Syllabus

Particle diameter and shape factor - particle size analysis - sieve analysis - particle size distribution - cumulative and differential methods of analysis - mean diameters - specific surface area and number of particles - sub-sieve analysis - pipette analysis - beaker decantation- elutriation - screening - effectiveness and capacity of screens and factors affecting them - types of industrial screens.

Principles of free and hindered settling - equal settling particles - classifiers - types of classifiers- mechanical and non-mechanical, pneumatic classifiers - principles of mineral beneficiation methods - jigging - Wilfley table - heavy media separation - magnetic and high-tension separation- froth flotation, principles, additives, and flotation cell arrangements batch and continuous thickening - Kynch theory - design of continuous thickener

filtration - theory of constant pressure and constant rate filtration - cake porosity and compressibility - filter aids - optimum filtration cycle - types of batch and continuous filters - washing of filter cakes - centrifugal methods of separation including centrifugal filtration - continuous centrifuge

Air separation methods-air separator - cyclone separation – electrostatic precipitation –Bag filters-Cottrell precipitator- scrubbing

Laws of comminution - mechanism and efficiency of size reduction - principles of important size reduction equipment - types and selection of equipment for all ranges - closed circuit and open circuit grinding - free crushing and choke feeding - wet and dry grinding

Mixing of granular solids and pastes - degree of mixing – mixers for non-cohesive and cohesive solids - storage and conveying of solids - silos, bins and hoppers - different types of conveyors - selection of conveyors

Expected Outcome

At the end of the course students will be able to

1. Determine particle size distribution of a given sample.
2. Select suitable size reduction equipment and estimate the energy requirements for a specified reduction in size of a given material.
3. Explain and analyse the concepts of various industrial operations such as Screening, Classification, Sedimentation, Filtration etc.

Text Books

1. McCabe W.L., Smith J.C. & Harriott P., Unit Operations in Chemical Engineering, McGraw Hill
2. Badger & Banchero, Introduction to Chemical Engineering, McGraw Hill

Reference Books

- Coulson J.M. & Richardson J.F., Chemical Engineering, Vol. II, ELBS, Pergamon Press
- Foust A.S. et al, Principles of Unit Operations, John Wiley
- Perry R.H., Chemical Engineers Handbook, McGraw Hill
- George Granger Brown, Unit Operations, Wiley

Course Plan

Module	Contents	Hours	Sem. exam marks
I	Particle diameter and shape factor - particle size analysis - sieve analysis - particle size distribution - cumulative and differential methods of analysis - mean diameters - specific surface area and number of particles - sub-sieve analysis - pipette analysis - beaker decantation- elutriation - screening - effectiveness and capacity of screens and factors affecting them - types of industrial screens.	8	15%
II	Principles of free and hindered settling - equal settling particles - classifiers - types of classifiers-mechanical and non-mechanical, pneumatic classifiers – principles of mineral beneficiation methods - jigging - Wilfley table - heavy media separation - magnetic and high-tension separation- froth flotation, principles, additives, and flotation cell arrangements batch and continuous thickening - Kynch theory - design of continuous thickener	8	15%
FIRST INTERNAL EXAMINATION			
III	Filtration - theory of constant pressure and constant rate filtration - cake porosity and compressibility - filter aids - optimum filtration cycle - types of batch and continuous filters -washing of filter cakes - centrifugal methods of separation including centrifugal filtration - continuous centrifuge	10	20%
IV	Air separation methods-air separator - cyclone separation – electrostatic precipitation –Bag filters-Cottrell precipitator- scrubbing and associated equipments used in process industries.	8	10%
SECOND INTERNAL EXAMINATION			
V	Laws of communition - mechanism and efficiency of size reduction - principles of important size reduction equipment - types and selection of equipment for all ranges - closed circuit and open circuit grinding - free crushing and choke feeding - wet and dry grinding	12	20%
VI	Mixing of granular solids and pastes - degree of mixing – mixers for non-cohesive and cohesive solids - storage and conveying of solids - silos, bins and hoppers - different types of conveyors - selection of conveyors	10	20%
END SEMESTER EXAM			

Evaluation Scheme

- **Internal Evaluation: Total Marks: 50**
  - (i) *Total Marks for Assignment/Seminar/Project/Case study or any other appropriate tool used for the evaluation of the course outcomes:* **10**
    A minimum of above two tools shall be used. If more than 2 tools are used, proportionate change shall be made in the marks so that the total contribution of marks for item (i) above remains at 10.
  - *(ii) Marks for Tests: Two tests each carrying 40% weightage shall be conducted with total contribution of* **40 marks**.

- **External Evaluation :** University Examination
  Maximum Marks : 100
  Exam Duration : 3 Hours

Question Paper Pattern:

There shall be **Three questions** uniformly covering Modules 1 and 2, each carrying 15 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in one main question with a total of 15 marks for all the subdivisions put together.
(2 x15= 30 Marks)

There shall be **Three questions** uniformly covering Modules 3 and 4, each carrying 15 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in one main question with a total of 15 marks for all the subdivisions put together.
(2 x15= 30 Marks)

There shall be **Three questions** uniformly covering Modules 5 and 6, each carrying 20 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in one main question with a total of 20 marks for all the subdivisions put together.
(2 x20= 40 Marks)