

## Solid-Fluid Mechanics and Mechanical Operations

1.1 Course Number: CH223

1.2 Contact Hours: 2-1-0 Credits: 8

1.3 Semester-offered: 2<sup>nd</sup> Year- odd

1.4 Prerequisite: Fluid Mechanics

1.5 Syllabus Committee Member: Dr G K Agrahari, Dr K G Biswas

2. **Objective:** The course covers the key features of industrially applied solid-fluid separation/purification operations. It also covers the operations like Agitation, mixing, storage and conveying of fluids and solids.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topics	Lectures
1	Fluid Flow Past Immersed Bodies	Motion of particle in fluid, drag force, Settling velocity— Stokes' law, free settling, hindered settling	3
2	Flow through bed of particles	Fluid flow through packed beds - Ergun equation, Kozeny- Carman equation, Fluid flow through fluidized bed	6
3	Filtration and separation	Principles of flow through filter cakes and medium, Types of filters, pressure drop through filter cake, constant-pressure & constant rate filtration, Clarifying filters, Crossflow filtration, Membrane filtration, Sedimentation processes, Cyclone separation	7
4	Agitation and Mixing	Agitated vessels, power consumption of agitators, blending and mixing—suspension of solid particles, correlations for suspension	5
5	Solid particle size analysis and reduction	Particle shape, size and properties, screen analysis, particle size reduction, crushers, grinders, ultrafine grinders, particle size enlargement	4
6	Storage and Transportation	Bin, silos, hoppers, pneumatic and hydraulic transportation, conveyors	3
<b>Total</b>			<b>28</b>

## 4. Readings

### 4.1 Text Book:

1. McCabe, W. L., Smith, J. C. and Harriot, P., Unit Operations of Chemical Engineering, 5<sup>th</sup> Ed., McGraw Hill, New York, 1993.

### 4.2 Reference Books:

1. Alan. S. Foust, Leonard A. Wenzel, Curtis W. Clump, Lousi Maus, L. Bryce Andersen (Ed) Principles of Unit operations, WILEY, 2011.
2. Coulson & Richardson's Chemical Engineering Volume 2, Particle Technology and separation processes, Butterworth Heinmann, 2002.
3. G. G. Brown, Unit Operations, CBS Publishers, 2005

## 5. Outcome of The Course: After the successful completion of the course the students will be able to:

1. Understand the principles of flow through packed beds and fluidized beds, agitated vessels and mixers.
2. Acquire knowledge about particulate solids flow, size reduction of solids, and to select suitable industrial equipment for separation of solid particles from fluid streams