Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NCHD509	Fluidization Engineering	3	0	0	3

Course Objective

- To introduce the developments in fluidization engineering that are pertinent to the engineers and potential users of fluidized bed reactors and systems.
- This course is important for futuristic technologies such as fluidized bed coal and biomass gasifiers, solid flow systems etc.

Learning Outcomes

- Students will get understanding of the basic phenomenon of fluidization and the design of fluidized bed systems for various industrial applications including systems and design requirements for fluidized bed coal gasifiers, hydrogen generation units etc.

Unit No.	Description of Lectures	Contact Hours	Learning Outcomes
1.	**Introduction**: Definition and Origin, Terminology, Reasons for Studying Fluidized Beds, Phenomenon of fluidization, comparison with other contacting methods, industrial applications of fluidization, advantages and disadvantages of fluidized beds, industrial applications.	3	History and origin of fluidized bed system, technical terms used in fluidization engineering, applications of fluidized bed systems
2.	**Properties, Minimum Fluidization, and Geldart Group**: Fluid Properties, Gas Properties, Liquid Properties, Individual Particle Properties, Bulk Particle Properties, Minimum Fluidization Velocity, the Geldart classification of particles	8	Knowledge of individual and bulk particle properties, pressure drop, and particle classification
3.	**Fundamentals of fluidization**: Characterization of bed particles, regime of operations in gas-solid contacting, fluidization without carryover of particles, types of gas fluidization without carryover, fluidization with carryover of particles, types of gas fluidization with carryover, mapping of fluidization regimes.	8	Knowledge of fluidization principles, types of gas fluidizations, and their mapping
4.	**Contacting regimes:** Gas-solid interaction in the gas entry region of the bed, types and design of distributors, power consumption, gas-solid interaction in the bubbling bed - bubbles in dense beds, bubbling beds, the lean zone above the dense bed, behavior of single rising bubble, estimation of bed properties, physical and flow models for bubbling fluidization bed, freeboard behavior, entrainment and elutriation, estimation of TDH, gas dispersion and interchange in bubbling bed, applications.	8	Knowledge of different contacting regimes in fluidized bed systems and different zones and regimes in a fluidized bed system.

5.	**High-velocity fluidization:** Turbulent fluidized beds, fast fluidization, the freeboard-entrainment model applied to fast fluidization, pressure drop in turbulent and fast fluidization, mixing and movement of solids, applications.	**8**	Knowledge of high-velocity fluidized bed systems and their impact on the pressure drop, factors affecting high-velocity fluidization.
6.	**Design and application:** General design of a fluidized bed, case study of a process involving fluidized bed (e.g. FCC).	**7**	Knowledge of fluidized bed systems with the help of case study
	Total	**42**	

Textbook:

1. Kunii, D. Levenspiel, O. (1991) *Fluidization engineering*, 2nd Ed. Butterworth—Heinemann.

Reference Books:

1. Davidson, J.F. Clift, R. and Harrison, D. (1985) *Fluidization,* 2nd Ed., Academic Press, London.
2. Leva, M. (1959) *Fluidization,* McGraw-Hill, New York.