

Teaching Scheme and Syllabus

For

Bachelor of Technology

In

Chemical Engineering



Department of Chemical Engineering

Sardar Vallabhbhai National Institute of Technology

Minor in Chemical Engineering

Sr. No.	Semester	Subject	Code	Scheme	Credit	Notional hours of Learning (Approx.)
1.	IV	FLUID AND PARTICLE MECHANICS	CH210	3-1-0	4	60

L	T	P	C
3	1	0	4

1. Course Outcomes:

At the end of the course, the students will be able to

CO1	Predict the velocity profile and flow behaviour in various types of systems.
CO2	Calculate pressure loss and power requirement in different types of flow systems.
CO3	Compare and select appropriate types of fluid moving machineries for fluid transport.
CO4	Analyze and estimate the effects of different types of forces on fluid particle interactions in unit operations.
CO5	Predict behavior of fluid solid system based on the process variables.
CO6	Calculate efficiency and the size of the unit operations based on the desirable performance.

2. Syllabus:

INTRODUCTION	(02 Hours)
Definition of Unit Operations, Definition and basic concepts of fluid, Properties of fluids, Stress, Deformation, Dimensional analysis, Overview of different operations practiced in industry, some real Industrial examples.	
FLUID STATICS AND ITS APPLICATIONS	(04 Hours)
Nature of fluids: Incompressible and compressible fluids, Pressure concepts, Hydrostatic equilibrium in gravitational and centrifugal field, Manometers, Inclined manometer, Continuous gravity decanter and centrifugal decanter.	
BASIC EQUATIONS OF FLUID FLOW AND THEIR APPLICATIONS	(06 Hours)
Stream line and stream tubes, Average velocity, Mass velocity, Continuity equation, Momentum balance, Navier-Stokes equations, Bernoulli's equation.	
FLUID FLOW MEASUREMENTS	(03 Hours)
Fluid flow measurement: Venturi meter, Orifice meter, Rotameter, Pitot tubes, etc.	
FLUID MOVING MACHINERIES	(05 Hours)
Transportation and metering of fluids, Pipe, fitting and valves, Construction, working and characteristic features of various types of pumps, compressors, blowers and fans.	
PARTICLE CHARACTERIZATION	(04 Hours)
Particle size measurements, Describing the Size & shape of a Single Particle, Description of Populations of Particles, Conversion between Distributions, Bulk properties measurement, characterization of powder flowability & powder compaction, Sieving and other methods of size measurements: Sieve analysis.	

SIZE REDUCTION	(03 Hours)
Size reduction of solids, Mechanism of size reduction, Energy for size reduction, Laws of Crushers, Model Predicting Energy Requirement and Product Size Distribution, Types & Classification of size reduction equipment, Types of Milling Circuit: Open and closed-circuit grinding.	
FLUID FLOW THROUGH A PACKED BED OF PARTICLES & THEORY OF FILTRATION	(06 Hours)
Estimation of packed bed parameters, Prediction of pressure drop using Kozeny-Carman Equation, Ergun's equation.	
FLUIDIZATION OF SOLIDS	(05 Hours)
Estimation of fluidized bed parameters, Prediction of pressure drop and minimum fluidization velocity using Ergun's equation, Geldart's powder classification. Types of fluidization.	
PHYSICAL SEPARATORS	(07 Hours)
Filters, Cyclones, Electrostatic Precipitator, Fabric filters, Centrifugal Separators.	
Tutorial problems based on the topics covered during the theory classes.	(15 Hours)
(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3. Books Recommended:

1.	White F. M., "Fluid Mechanics", 7 th Ed., McGraw Hill, 2011.
2.	McCabe W.L., Smith J.C., Harriott P., "Unit Operations of Chemical Engineering", 6th & 7th Eds., McGraw-Hill, New York, 2001 & 2005.
3.	Coulson J.M., Richardson J.F., "Chemical Engineering", Vol. 2, 5 th Ed., Elsevier, New Delhi, 2002.
4.	Martin Rhodes, "Introduction to Particle Technology", 2nd Edition, John Wiley & Sons, 2008.
5.	Batchelor G. K., An Introduction to Fluid Dynamics, Cambridge Univ Press, 1967.