19FT203 FUNDAMENTALS OF FLUID MECHANICS

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	-	30	20	50	-	5	5	5

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with fundamentals of fluid statics, dynamics, compressible and incompressible fluids, fluidization, transportation and metering of fluids. The objective of this course is to train students on the basic concepts of fluid flow and its application to food process industries.
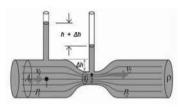
COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Understand basic principles of fluid mechanics.	1
2	Analyze fluid flow problems with the application of the momentum and energy equations.	2
3	Design the fluid machinery like pumps, compressors.	3
4	Investigate dimensionless groups by dimensional analysis.	4
5	Design of fluidized bed reactor.	3

SKILLS:

✓ *Analyze fluid flow situations for type of flow.*

✓ *Prescribe conditions for maintaining a given type of flow.*

✓ *Determine the velocity and pressure drop of fluid flowing through pipes.*

✓ *Select a meter for measuring flow rate and velocity of a flowing fluid.*

✓ *To select the pump for a given engineering application.*

UNIT - I   **L-9**

INTRODUCTION TO FLUIDS : Definitions; Properties; Units and dimensions; Measurement of fluid pressure - absolute and gauge pressure, pressure head of the liquid; Compressible and non compressible fluids; Surface tension; Capillarity; Pressure measuring devices - piezometer, simple manometers, inclined manometers, differential manometers, problems.

UNIT - II   **L-9**

KINEMATICS OF FLUID FLOW : Introduction and classification of flows-steady, uniform, non uniform, laminar and turbulent, continuity of fluid flow, boundary layer, fully developed flow; Bernoulli's theorem - problems on bernoulli's theorem; Venturimeter; Pitot tube; Orifice meter; Rotameter; Problems on venturimeter and orifice meter.

UNIT - III   **L-9**

FLOW THROUGH SIMPLE PIPES : Loss of head in pipes-darcy's formula, chezy's formula for loss of head in pipes, minor losses of energy, Hagen Poiseuille equation, drag, drag coefficients, terminal velocity; Fluidization - introduction, types of fluidization, applications of fluidization, problems on fluidization.

UNIT - IV   **L-9**

FLOW THROUGH ORIFICES : Types of orifices; Jet of water; Hydraulic coefficients - experimental method for hydraulic coefficients; Different discharges - discharge through a rectangular orifice, discharge over a triangular notch, stepped notch; Dimensional analysis - similitude, buckingham's pi theorem, hydraulic similitude.

UNIT - V   **L-9**

DESIGN OF PIPES AND PUMPS : Pipes; Fittings; Valves; Pumps; Developed head & power requirement in pumps; Suction lift; Cavitation; Classification of pumps-reciprocating pump, centrifugal pumps, power requirement in pumps, introduction to compressors, fans and blowers.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS   **TOTAL HOURS: 30**

1. Identification of laminar and turbulent flows.

2. Verification of Bernoulli's Equation.

3. Measurement of flowing fluid using Venturimeter.

4. Measurement of flowing fluid using Orifice meter.

5. Determination of friction loss in fluid flow through pipes.

6. Determination of friction loss in fluid flow through fittings.

7. Determination of pressure drop in packed bed.

8   Determination of pressure drop in fluidized bed.

9. Determination of characteristics of centrifugal pump.

10. Determination of characteristics of reciprocating pump.

11. Determination of Head loss due to Sudden Expansion.

12. Determination of Head loss due to Sudden Contraction.

13. Calculating Coefficient of discharge of V – notch.

14. Measurement of flowing fluid using Rotameter.

15. Determination of Hydraulic coefficients for an orifice.

TEXTBOOKS:

1. P. N. Modi and S. M. Seth, "Hydraulics and Fluid Mechanics", 14th edition, Standard Publishers, 2002.

2. R. K. Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machinery",1st edition, Laxmi Publications Pvt. Ltd, 2002.

REFERENCEBOOKS:

1. R. J. Grade, "Fluid Mechanics Through Problems", 1st edition, Wiley Eastern Ltd, 1992.

2. A. M. Micheal and S. D. Khepar, "Water Well and Pump Engineering", 2nd edition, Tata McGraw Hill, 2005.

3. J. Lal, "Hydraulic Machines", 6th edition, Metropolitan Book house, 2001.

4. A. M. Michael, "Irrigation Theory and Practice", 2nd edition, Vikas Publishing House, 2008.