# 16FT204 FUNDAMENTALS OF FLUID MECHANICS

Hours Per Week :

| L | T | P | C |
|---|---|---|---|
| 3 | - | 2 | 4 |

Total Hours :

| L | T | P |
|---|---|---|
| 45 | - | 30 |

| WA/RA | SSH/HSH | CS | SA | S | BS |
|---|---|---|---|---|---|
| 20 | 45 | - | 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 chemical process industries.

## Course Outcomes:

The student will be able to:

- understand basic principles of fluid mechanics.
- analyze fluid flow problems with the application of the momentum and energy equations.
- analyze pipe flows as well as fluid machinery.

## 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.*
- ✓ *Select the pump for a given engineering application*.

**UNIT - 1** **L-9**

**INTRODUCTION TO FLUIDS:** Definitions, Properties, Units and dimensions, Measurement of fluid pressure, Absolute and gauge pressure: Pressure head of the liquid, Pressure on vertical rectangle surfaces, Compressible and Non compressible fluids, Surface tension, Capillarity, Pressure measuring devices: Piezometer, Simple manometers, Inclined manometers, Differential manometers, Problems.

**UNIT - 2** **L-9**

**KINEMATICS OF FLUID FLOW :** Introduction, 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 ,Orifice meter.

**UNIT - 3** **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 - 4** **L-9**

**FLOW THROUGH ORIFICES**: Types of orifices, Jet of water, Hydraulic coefficients, Experimental Method for Hydraulic Coefficients, Discharge through a rectangular orifice, Discharge over a Triangular Notch, Stepped Notch, Dimensional analysis and similitude, Buckingham's pi theorem, Hydraulic similitude.

**UNIT - 5** **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, Pressure variation, Work efficiency, Types of chambers: Selection and sizing, 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.

## ACTIVITIES:

- *Calibration of rotameter.*
- *Calibration of manometer.*
- *Fabrication of Venturi meter.*
- *Fabrication of Orifice meter.*

**TEXTBOOKS**

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

**REFERENCE BOOKS**

1. R. K. Bansal, “A Text Book of Fluid Mechanics and Hydraulic Machinery”,1st edition, Laxmi Publications (P)Ltd,2002.
2. R. J. Grade, “Fluid Mechanics Through Problems”, 1st edition, Wiley Eastern Ltd, 1992.
3. A. M. Micheal and S. D. Khepar, “Water Well and Pump Engineering”, 2nd edition, Tata McGraw Hill, 2005.
4. J. Lal, “Hydraulic Machines”, 6th edition, Metropolitan Book house, 2001.
5. A. M. Michael, “Irrigation Theory and Practice”, 2nd edition, Vikas Publishing House, 2008.