

20PEB204					FLUID MECHANICS					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the fundamentals of fluid mechanics.
- Improve skills to design flow loops with minimal pressure losses.
- Improve analytical skills to understand complex petroleum engineering problems related to flow assurance.
- Enhance knowledge to understand more advanced courses like transport phenomenon, pipeline engineering etc.

Unit – I

Hours: 10

Laminar and Turbulent Flow: Definition, relation between pressure and shear stresses, laminar flow through round pipe

Flow Through Pipes and Fittings: Total energy line, Hydraulic grade line, frictional Energy losses through pipe, DarcyWeisbach equation, oody diagram, pipes in series and parallel, Types of fittings, energy losses in fittings.

Unit – II

Hours: 10

Boundary Layer Theory: Development of Boundary Layer on a flat plate, Laminar and Turbulent Boundary Layers, Von Karman's Analysis, Laminar sub layer, Prandtl 1/7th power law, Separation of Boundary Layer and Methods of Controlling, Flow around Immersed Bodies, Lift and Drag, Classification of Drag, Flow around circular cylinder and Aerofoil, Development of lift on Aerofoil,

Turbulence: Mean and fluctuating velocities, Scale and intensity of turbulence, Prandtl mixing length, Turbulent boundary layers, universal velocity profile and applications.

Unit – III

Hours:10

Dimensional Analysis: Dimensions of physical quantities, dimensional homogeneity, Buckingham pi Theorem, important dimensionless numbers, Model analysis (Reynolds, Froude and Mach)

FLOW measurement

Application of Bernoulli's equation, Pitot tube, Venturi meter, Orifice meter, Rotameter, Triangular Notch & Rectangular Notch, Mass flow meters etc

Unit – IV

Hours: 09

Pumps and Compressors

Classification of Pumps, centrifugal pumps, types, and head developed, Characteristic curves, selection criteria. Reciprocating and Rotary pumps, selection criteria,

Compressible fluid flow: Ideal gas relations, Mach number, speed of sound. Isentropic flow of ideal gas. Types of compressors, COP, Selection criteria

Fluid Kinematics: Types of flow (steady vs. unsteady, uniform vs. non-uniform, laminar vs. turbulent, One, Two and Three dimensional, compressible vs. incompressible, rotational vs. Irrotational), Stream lines, path lines, streak lines, velocity components, convective, local and total acceleration, velocitypotential, stream function, continuity equation in Cartesian co-ordinates Fluid Dynamics: Introduction to Navier-Stokes'equation, Euler's equation of motion along a stream line, Bernoulli's equation, Application of Bernoulli's equationTotal

Max <40 Hrs>

COURSE OUTCOMES

On completion of the course, student will be able to

CO1- Understand the principles of fluid flow operations.

CO2- Apply and evaluate the theoretical importance and relevance of fluid flow in chemical process industry

CO3- Comprehend and analyse fluid mechanics problems with the application of conservation principles of mass, energy and the momentum

CO4- Design fluid transportation systems such as pumps, compressors and pipe network etc.

CO5- Evaluate the fluid transportation devices for process applications.

CO6- Compute power requirement in fixed bed system and determine minimum fluidization velocity in fluidized bed

TEXT / REFERENCE BOOKS

1. S. Gupta, Fluid Mechanics and Hydraulic Machines, Pearson Publishers.
2. Cengel and Cimbala, Fluid Mechanics, Tata-McGraw Hill Publishers.
3. F. White, Fluid Mechanics, Tata-McGraw Hill publishers.
4. R. Fox and A. McDonald, Fluid Mechanics, John Wiley Publishers.
5. J. Douglas, J. Gasiorek, J. Swaffield, and L. Jack, Fluid Mechanics, Pearson Publishers.
6. C. Ojha, P. Bernstein and P. Chandramouli, Fluid Mechanics and Machinery, Oxford University Press.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each-No choice

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks