



Unit I

Chapter 1 : Properties of Fluids	1-1 to 1-21
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Syllabus : Definition of fluid and fluid mechanics : examples and practical applications, Classification of fluids :Real and Ideal, Physical properties of fluids : mass density, specific weight, specific volume, relative density, viscosity, Newton's law of viscosity, Dynamic and kinematic viscosity, compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure.

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1.2	Development of Fluid Mechanics, Examples and Practical Applications.....	1-2
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1.8	Relative Density (s)	1-6
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1.10.1	Cavitation	1-10
1.11	Compressibility and Elasticity	1-10
1.12	Surface Tension and Capillarity (Cohesion and Adhesion)	1-11
1.12.1	Surface Tension (σ).....	1-11
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Chapter 2 : Fluid Statics	2-1 to 2-48
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Syllabus : Basic equation of hydrostatics, concept of pressure, pressure head, Pascal's Law, measurement of pressure (absolute, guage) Principle of manometers : Balancing liquid column, dead weight, pressure transducers and their types. Total pressure and centre of pressure : on plane horizontal, vertical, inclined and curved surfaces practical applications. Buoyancy and Floatation : Principle of floatation and buoyancy, stability of floating and submerged bodies.

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2.2.1	Simple Manometers	2-5
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2.3	Pressure Transducers and their Types	2-10
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2.5.6	Practical Applications of Total Pressure and Centre of Pressure	2-20
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Unit II

Chapter 3 : Fluid Kinematics 3-1 to 3-24

Syllabus : Eulerian and Lagrangian approach, velocity and acceleration, and their components in Cartesian co-ordinates, Classification of flows, stream line, stream tube, path line, streak line, control volume. Equation of continuity for 3-D flow in Cartesian co-ordinates, components, components of rotation, velocity potential, stream function and flow net.

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3.4.2	Uniform and Non-uniform Flow.....	3-2
3.4.3	One, Two, Three-Dimensional Flows.....	3-2
3.4.4	Rotational and Irrotational Flow	3-3
3.4.5	Laminar and Turbulent Flow	3-3
3.4.6	Critical, Subcritical and Supercritical Flows	3-4
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3.5	Description of Flow Pattern - Stream Line, Stream Tube, Path Line and Streak Line	3-4
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3.5.3	Path Line.....	3-5
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3.6	Acceleration of a Fluid Particle	3-5
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3.7	Basic Principles of Fluid Flow (Principles of Conservation of Mass, Energy and Momentum)	3-7
3.8	Concepts of System and Control Volume.....	3-7
3.9	Continuity Equation	3-7

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Chapter 4 : Fluid Dynamics 4-1 to 4-22

Syllabus : Forces acting on fluid mass in motion, Euler's equation of motion along a streamline and its integration to get Bernoulli's equation and its limitations, Modified Bernoulli's equation, concept of HGL and TEL, Application of Bernoulli's equation to measure discharge and velocity of flow : Venturimeter, Orifice meter, Rotameter and Pitot tube.

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4.3	Euler's Equation along a Streamline.....	4-2
4.4	Integration of Euler's Equation to Obtain Bernoulli's Equation	4-3
4.5	Assumptions of Bernoulli's Equation, its Applications and Limitations and Significance of Each Term.....	4-4
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4.7	Total Energy Line (TEL) and Hydraulic Gradient Line (HGL)	4-5
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4.9	Fluid Power	4-6
4.10	Practical Applications of Bernoulli's Equation	4-7
4.10.1	Venturimeter.....	4-7
4.10.2	Orifice Meter.....	4-10
4.10.3	Pitot Tube.....	4-10
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➤	Model Question Paper (In Sem.)	M-1 to M-5

**Unit - III****Chapter 5 : Dimensional Analysis and Model Studies****5-1 to 5-21**

Syllabus : Dimensional homogeneity, dimensional analysis using Buckingham's π theorem method, geometric, kinematic and dynamic similarity, important dimensionless Numbers (Reynolds No., Froude No., Mach No. and Weber No) and their significance, Model Laws (Reynold's law and Froude's Law)

5.1	Introduction and Applications of Dimensional Analysis	5-1
5.1.1	Applications of Dimensional Analysis	5-1
5.2	Dimensions of Physical Quantities	5-1
5.3	Common Variables in Fluid Flow and their Units and Dimensions.....	5-2
5.4	Dimensional Homogeneity (Fourier's principle).....	5-3
5.5	Methods of Dimensional Analysis.....	5-4
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5.5.3	Superfluous and Omitted Variables and Limitation of Dimensional Analysis	5-5
5.6	Model Investigations.....	5-5
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5.7.3	Dynamic Similarity.....	5-6
5.8	Force Ratios (Important Dimensionless Parameters) and Model Laws	5-6
5.8.1	Reynold's Number and Reynold's Model Law.....	5-7
5.8.2	Froude Number and Froude's Model Law.....	5-8
5.8.3	Mach Number.....	5-9
5.8.4	Euler Number	5-10
5.8.5	Weber Number and Weber's Model Law	5-10
5.9	Types of Models.....	5-10
5.10	Solved Examples : Dimensional Analysis.....	5-10

Chapter 6 : Boundary Layer Theory**6-1 to 6-20**

Syllabus : Concept, development of boundary layer on a flat plate and factors affecting growth, Boundary layer thickness, displacement thickness, momentum and energy thicknesses, Laminar sub layer, Local and mean drag coefficients, Hydrodynamically smooth and rough boundary, boundary layer separation and methods to control separation

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6.3	Thicknesses of Boundary Layer	6-2
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6.3.2	Displacement Thickness (δ^*).....	6-2
6.3.3	Momentum Thickness (θ).....	6-3
6.3.4	Energy Thickness (δE).....	6-4
6.4	Development of Boundary Layer on a Flat Plate and Factors Affecting Growth and Laminar Sub Layer	6-4
6.5	Von-Karman Momentum Integral Equation.....	6-6
6.6	Laminar Boundary Layer and Local and Mean Drag Coefficients	6-6
6.7	Turbulent Boundary Layer and Local and Mean Drag Coefficients	6-7
6.8	Boundary Layer on Rough Surfaces and Hydrodynamically Smooth and Rough Boundaries	6-8
6.9	Separation of Boundary Layer	6-9
6.9.1	Methods of Controlling Separation.....	6-11
6.10	Solved Examples.....	6-12

Unit - IV**Chapter 7 : Laminar and Turbulent Flow through Pipe****7-1 to 7-22**

Syllabus : Characteristics of laminar flow, laminar flow through a circular pipe: Hagen Poiseuille equation, Characteristics of turbulent flow, instantaneous velocity, temporal mean velocity, scale of turbulence and intensity of turbulence, Prandtl's mixing length theory, velocity distribution equation, variation of friction factor for laminar flow and for turbulent flow, resistance to flow in smooth and rough pipes, friction factor for commercial pipes, Moody's diagram.

7.1	Introduction	7-1
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7.2	Steady and Uniform Laminar Flow in Circular Pipe (Hagen-Poiseuille Equation).....	7-2
7.3	Introduction and Characteristics of Turbulent Flow.....	7-5
7.4	Shear Stress in Turbulent Flow.....	7-6
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7.4.2	Prandtl's Mixing Length Theory.....	7-7
7.5	Velocity Distribution for Turbulent Flow in Pipes.....	7-7
7.5.1	Smooth Pipes.....	7-8
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7.6	Frictional Resistance in Pipe Flow (Darcy-Weisbach Equation).....	7-9
7.7	Friction Factor in Smooth and Rough Pipes.....	7-10
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7.7.2	Commercial Pipes and Moody's Diagram.....	7-11
7.7.3	Aging of Pipes.....	7-12
7.8	Solved Examples.....	7-12

Chapter 8 : Flow through Pipes 8-1 to 8-24

Syllabus : Energy loss in pipe flow, Equation for major loss and minor losses in pipe, flow through pipes in simple and compound pipe, pipes in series, parallel, Dupuit's equation, pipe network analysis by Hardy Cross method, Introduction to siphon.

8.1	Pipe Flow Systems.....	8-1
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8.1.2	Energy Losses in Pipes.....	8-1
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8.1.5	Concept of Equivalent Length.....	8-5
8.1.6	Pipes in Series.....	8-5
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8.1.8	Equivalent Pipes and Dupuit's Equation.....	8-6
8.1.9	Flow through Long Pipe (between Two Reservoirs and from a Single Reservoir).....	8-6
8.2	Introduction to Siphon.....	8-7
8.2.1	Pipeline with a Pump or Turbine.....	8-8
8.2.2	Pipe Network Analysis by Hardy Cross Method.....	8-8
8.3	Solved Examples.....	8-9

Unit V

Chapter 9 : Open Channel Flow and Depth Energy Relationships 9-1 to 9-32

Syllabus : a) Introduction to Open channel flow : Classification of channels, channel flows and geometric elements of channel, Basic governing equations of Channel flow viz. continuity equation, energy equation and momentum equation, One dimensional approach, Velocity distribution in open channel flow.

b) Uniform flow in open channels : Uniform flow formulae: Chezy's and Manning's formulae ; Factors affecting Manning's roughness coefficient; Important terms pertaining to uniform flow, viz. normal depth, conveyance, section factor, concept of second hydraulic exponent, Uniform flow computations. Most efficient channel sections: rectangular, triangular and trapezoidal.

Depth-Energy Relationships in Open Channel Flow : Specific energy and Specific force diagram, Depth discharge Diagram, Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it, Important terms pertaining to critical flow viz. section factor, concept of first hydraulic exponent

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9.2	Classification of Open Channel.....	9-1
9.3	Classification of Channel Flow.....	9-2
9.4	Geometrical Elements of a Channel.....	9-3
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9.4.2	Depth of Flow Section (d).....	9-3
9.4.3	Stage.....	9-3
9.4.4	Top Width (T).....	9-3
9.4.5	Area of Flow or Water Area (A).....	9-3
9.4.6	Wetted Perimeter (P).....	9-3
9.4.7	Hydraulic Radius (R).....	9-4
9.4.8	Hydraulic Depth (D).....	9-4
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9.5	Basic Governing Equation of Channel Flow Continuity Equation.....	9-4
9.5.1	Continuity Equation for Open Channel Flow.....	9-4
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9.5.3	Momentum Equation.....	9-5



9.6	One Dimensional Approach.....	9-5	10.1	Gradually Varied Flow (GVF).....	10-1
9.7	Velocity Distribution in Open Channel Flow	9-6	10.1.1	Basic Assumptions of GVF.....	10-1
9.8	Solved Examples.....	9-7	10.1.2	Classification of Channel Bed Slopes	10-1
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9.9.2	Manning's Formula.....	9-9	10.2.2	Various GVF Profiles.....	10-4
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9.10	Important Terms Pertaining to Uniform Flow	9-10	10.3.1	Step Method.....	10-7
9.11	Most Efficient Channel Section.....	9-11	10.3.2	Graphical Method	10-8
9.11.1	Rectangular Section	9-11	10.3.3	Direct Integration Method (Bresse's Method).....	10-8
9.11.2	Trapezoidal Section.....	9-11	10.3.4	Ven Te Chow's Method	10-9
9.11.3	Triangular Section	9-12	10.4	Solved Examples.....	10-10
9.12	Solved Examples.....	9-13	10.5	Practical Problems Involving Fluid Flow Around Submerged Objects	10-23
9.13	Specific Energy Diagram	9-21	10.6	Definitions of Expressions for Drag, Lift, Drag Coefficient, Lift Coefficient, Types of Drag	10-23
9.14	Specific Force Diagram	9-21	10.6.1	Drag and Lift.....	10-23
9.15	Depth Discharge Diagram	9-22	10.6.2	Drag and Lift Coefficient.....	10-24
9.15.1	Applications of Depth Discharge Diagram	9-22	10.6.3	Types of Drag.....	10-24
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			10.9	Introduction to Drag on Sphere, Cylinder, Flat Plate and Aerofoil	10-26
			10.9.1	Drag on Sphere	10-26
			10.9.2	Drag on Cylinder	10-27
			10.9.3	Flow Over Flat Plate.....	10-28
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			10.10.1	Introduction to Magnus Effect.....	10-28
			10.10.2	Lift on Cylinder	10-29
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			10.11	Polar Diagram	10-30
			10.12	Solved Examples.....	10-31

Unit VI

Chapter 10 : Gradually Varied Flow (GVF) and Flow around Submerged Bodies 10-1 to 10-46

Syllabus :

a) Gradually Varied Flow (GVF) in Open Channel Flow : Theory and Computation Basic Assumptions of GVF; Dynamic equation of GVF - Alternative forms; Classification of channel bed slopes, Various GVF profiles, Methods of GVF computations: Direct Step method. (mention of other method)

b) Fluid Flow around Submerged Objects : Practical problems involving fluid flow around submerged objects, Definitions and expressions for drag, lift, drag coefficient, lift coefficient, types of drag. Introduction to Drag on sphere, cylinder, flat plate and Aerofoil, Karman's vortex street, Development of lift, Introduction to Magnus effect, Lift on cylinder and Aerofoil, Polar diagram.

➤ **Model Question Paper (End Sem.)..... M-1 to M-6**

