COURSE TEACHING STRUCTURE
Course: Fluid Mechanics

Dept: CIVIL **Class: SE**

Unit 1: Properties of Fluids :(10 Lectures & 18-20 Marks)

Unit No.	Lecture No.	Topic Detail	Duration (in Minutes)	Topic Based On	Marking Scheme
1	01	**Properties of Fluids**: Characteristics of Fluids, Density, types of fluid and rheology	20	Theory	4
	02	Specific Weight, Specific Gravity.	30	Theory	4
	03	Newton's law of viscosity, Dynamic Viscosity, Kinematics Viscosity, measurement of viscosity	30	Theory	6
	04	Application based numerical on viscosity-flow through pipe, Lubrication, bearing, brake fluids, parallel plates, rotating shafts etc.	30	Theory + Numerical	8-10
	05	Surface Tension, Capillarity, Compressibility, Vapor pressure.	60	Theory	6
	06	**Fluid Statics:** Pascal's Law, hydrostatics law, hydraulic ram, Pressure measurement: pressure scale, piezometer, and barometer.	30	Theory + Numerical	8-10
	07	Manometer - simple, inclined, differential, micro manometer, inverted Pressure at a point, Total Pressure. Balancing liquid column, dead weight, pressure transducers and their types.	30	Theory + Numerical	8-10
	08	Centre of pressure, Pressure on a plane inclined.	20	Theory + Numerical	8-10
	09	Curved surfaces, Buoyancy, meta center and floatation.	30	Theory	4
	10	Buoyancy, meta center and floatation, stability of floating and submerged bodies	30	Theory	6

	11	Revision of all Topics taught	90	Theory + Numerical	-
	12	Unit Test-1	30	Theory + Numerical	30

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Unit 2: Fluid Kinematics: (8 Lectures & 18 Marks)

Unit No.	Lecture No.	Topic Detail	Duration (in Minutes)	Topic Based On	Marking Scheme
2	1	**Fluid Kinematics:** Eulerian and langragian approach of fluid flow.	20	Theory	4
	2	Total or material derivative for velocity field.	30	Theory	4
	3	acceleration fields, continuity equation in 1D & 3D flow,	30	Theory	6
	4	Types of flows (One , two, three dimensional , steady unsteady, uniform, non-uniform,	30	Theory + Numerical	8-10
	5	Laminar, turbulent, compressible, incompressible, rotational, irrotational).	60	Theory	6
	6	Visualization of flow field (Stream, Path and Streak line).	30	Theory + Numerical	8-10
	7	Velocity in two dimensional flow	30	Theory + Numerical	8-10
	8	Stream function and velocity potential function.	20	Theory + Numerical	8-10
	9	**Fluid Dynamics:** introduction to flow models- control volume and infinitesimally small element.	30	Theory	4
	10	Continuity and Linear momentum Equation using differential Approach, Introduction to Navier – Stokes Equation.	30	Theory	6
	11	Euler equation of motion along streamline,	30	Theory + Numerical	8-10
	12	Derivation of Bernoulli's equation along stream line	60	Theory	6
	13	Concept of HGL and THL or TEL.	30	Theory + Numerical	8-10

	14	Application of Bernoulli's equation to venture meter, Pitot tube.	30	Theory + Numerical	8-10
	15	Orifices, Orifice meter, introduction to coriolis flow meter,	20	Theory + Numerical	8-10
	16	Introduction to orifices, notches & weirs	20	Theory	4
	17	Entrance region theory,	30	Theory	4
	18	velocity and shear Stress distribution for laminar flow through pipe	30	Theory	6
	19	fixed parallel plates and Couette flow, velocity profile of turbulent flow	30	Theory + Numerical	8-10
	20	Revision of all Topics taught	90	Theory + Numerical	-
	21	Unit Test-1	30	Theory + Numerical	30

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Unit 3: Fluid Dynamics: (11 Lectures & 18 Marks)

Unit No.	Lecture No.	Topic Detail	Duration (in Minutes)	Topic Based On	Marking Scheme
3	1	Dimensional Analysis: Dimensions of physical, quantities, dimensional homogeneity.	20	Theory	4
	2	Introduction, system of dimensions	30	Theory	4
	3	Dimensional homogeneity	30	Theory + Numerical	6
	4	Buckingham Theorem, important dimensionless numbers,	30	Theory + Numerical	8-10
	5	Repeating variables, dimensionless numbers and their physical significance	20	Theory	6
	6	Model & prototype, similarity, scaling parameters , model laws	30	Theory + Numerical	8-10
	7	Objectives, importance and application of model studies.	30	Theory + Numerical	8-10
	8	**External flows:** Boundary layer formation for flow over Flat plate.	20	Theory + Numerical	8-10
	9	Boundary layer thickness:- displacement, momentum.	30	Theory	8
	10	Energy, Separation of Boundary Layer and Methods of Controlling.	60	Theory	6
	11	Forces on immersed bodies: -Lift and Drag, flow around cylinder, Application	90	Theory + Numerical	6
	12	Revision of all Topics taught	90	Theory + Numerical	-

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Unit 4: Internal Flow & External Flow: (05 Lectures & 18 Marks)

Unit No.	Lecture No.	Topic Detail	Duration (in Minutes)	Topic Based On	Marking Scheme
4	1	**Internal Flow & External Flow:** Laminar and Turbulent flow physics.	90	Theory	4
	2	Entrance region and fully developed flow.	45	Theory + Numerical	6
	3	**Flow Through Pipes:** Energy losses through pipe-Major and Minor losses.	60	Theory + Numerical	8-10
	4	Darcy-Weisbach equation, pipes in series, pipes in parallel.	45	Theory	6
	5	Concept of equivalent pipe, Moody's diagram, Siphons, Transmission of power.	40	Theory	6
	6	Revision of all Topics taught	90	Theory + Numerical	-
	7	Unit Test-1	30	Theory + Numerical	30

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Unit 5: Dimensional Analysis: (07 Lectures & 18 Marks)

Unit No.	Lecture No.	Topic Detail	Duration (in Minutes)	Topic Based On	Marking Scheme
5	1	Introduction to Open channel flow: Classification of channels, channel flows and geometric elements of channel	40	Theory	8
	2	Basic governing equations of Channel flow viz. continuity equation, energy equation and momentum equation,	30	Theory	4
	3	One dimensional approach, Velocity distribution in open channel flow.	30	Theory + Numerical	6
	4	Uniform flow in open channels: Uniform flow formulae: Chezy's and Manning's formulae; Factors affecting Manning's roughness coefficient	30	Theory + Numerical	8-10
	5	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	20	Theory	6
	6	Depth-Energy Relationships in Open Channel Flow: Specific energy and Specific force diagram, Depth discharge Diagram, Critical depth, Conditions for occurrence of critical flow	30	Theory + Numerical	8-10
	7	Revision of all Topics taught	90	Theory + Numerical	-
	8	Unit Test-1	30	Theory + Numerical	30

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Unit 6: Dimensional Analysis: (06 Lectures & 18 Marks)

Unit No.	Lecture No.	Topic Detail	Duration (in Minutes)	Topic Based On	Marking Scheme
6	1	Froude's number, flow classification based on it, Important terms pertaining to critical flow viz. section factor, concept of first hydraulic exponent	30	Theory + Numerical	6
	2	Gradually Varied Flow (GVF) in Open Channel Flow: Theory and Computation Basic Assumptions of GVF; Dynamic equation of GVF - Alternative forms	30	Theory + Numerical	8-10
	3	Classification of channel bed slopes	20	Theory	6
	4	Various GVF profiles, Methods of GVF computations: Direct Step method.(mention of other method)	30	Theory + Numerical	8-10
	5	**Fluid Flow around Submerged** Objects: Practical problems involving fluid flow around submerged objects	30	Theory + Numerical	8-10
	6	Definitions and expressions for drag, lift, drag coefficient, lift coefficient, types of drag. Introduction to Drag on sphere, cylinder,	30	Theory + Numerical	8-10
	7	flat plate and Aerofoil, Karman's vortex street, Development of lift, Introduction to Magnus effect, Lift on cylinder and Aerofoil, Polar diagram.	30	Theory + Numerical	8-10
	8	Revision of all Topics taught	90	Theory + Numerical	-
	9	Unit Test-1	30	Theory + Numerical	30

Total = 60+15(For Revision and Doubt Solving Sessions)

Text Books:

1) Fundamentals of Fluid Mechanics- Munson, Young and Okiishi- Wiley India
2) Fluid Mechanics- Potter Wiggert –Cengage Learning
3) Introduction to Fluid Mechanics- Fox, Pichard , McDonald- Wiley
4) Fluid Mechanics,- Dr. R.K. Bansal- Laxmi Publication (P) Ltd. New Delhi
5) Hydraulics and Fluid Mechanics, - Modi P. N. and Seth S. M -Standard Book House.
6) Fluid Mechanics,- Cengel&Cimbla- TATA McGraw-Hill
7) Fluid Mechanics- White- TATA McGraw-Hill

Reference Books:

1) Fluid Mechanics- Kundu, Cohen, Dowling- Elsevier India
2) Fluid Mechanics – Chaim Gutfinger David Pnueli-Cambridge University press.
3) Introduction to Fluid Mechanics-Edward Shaughnessy, Ira Katz James Schaffer-OXFORD