1151AU213	FLUID MECHANICS AND MACHINERY	L	T	P	C
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1. Preamble:

This course provides an introduction to the properties and behaviour of fluids. It introduces dimensional analysis and enables to apply the concepts in civil engineering, pipe networks and channel.

2. Pre-requisite

1151AU213	Engineering Physics

3. Links to other courses

- Computational Fluid Dynamics

4. Course Educational Objectives

- Apply fundamental knowledge of mathematics to modeling and analysis of fluid flow problems in civil and environmental engineering.
- Illustrate the experiments in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
- Recognise the awareness of disasters caused by an incorrect analysis in hydraulic engineering system.

5. Course Outcomes

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Comprehend the different concepts and properties associated with fluid and verify the Bernoulli's theorem for its applications.	K3, S3
CO2	Apply the fluid kinematics, boundary layer concepts related to fluid flow and verify those with Orifice meter, Venturi meter and pitot tube.	K3, S3
CO3	Analyze the different types of fluid flow, energy, friction and losses through the pipes and verify it through major/minor loss and rotameter.	K3, S3
CO4	Explain the working and application of various hydraulic turbines and derive the performance curves for Pelton wheel turbine, Francis turbine and Kaplan turbine.	K3, S3
CO5	Explain the working and application of various hydraulic pumps and derive the performance curves for Centrifugal, Reciprocating, Gear and Submersible pump.	K3, S3

6. Correlation of COs with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	M	M	L						L	H	H
CO2	H	H	H	M	M	L						L	H	H
CO3	H	H	H	M	M	L						L	H	H
CO4	H	H	H	M	M	L						L	H	H

CO5	H	H	H	M	M	L						L	H	H

H- High; M-Medium; L-Low

7. Course Content

UNIT – I: BASIC CONCEPTS AND PROPERTIES L- 9 P-6

Fluid – Definition, Distinction Between Solid and Fluid - Units And Dimensions - Properties of Fluids - Density, Specific Weight, Specific Volume, Specific Gravity, Temperature, Viscosity, Compressibility, Vapour Pressure, Capillary and Surface Tension - Fluid Statics: Concept of Fluid Static Pressure, Absolute and Gauge Pressures - Pressure Measurements by Manometers and Pressure Gauges.

UNIT – II: FLUID KINEMATICS AND BOUNDARY LAYER CONCEPTS L- 9 P-6

Fluid Kinematics - Flow Visualization - Lines of Flow - Types of Flow - Continuity Equation (One Dimensional Differential Forms) - Fluid Dynamics - Equations of Motion -Navier - Stokes's Equation (Statement Only) Euler's Equation Along a Streamline - Bernoulli's Equation – Applications - Venturi Meter, Orifice Meter, Pitot Tube - Boundary Layer Flows, Boundary Layer Thickness, Boundary Layer Separation - Drag and Lift Coefficients.

UNIT – III: FLOW THROUGH PIPES AND DIMENSIONAL ANALYSIS L- 9 P-6

Viscous Flow - Shear Stress, Pressure Gradient Relationship - Laminar Flow Between Parallel Plates - Laminar Flow Through Circular Tubes (Hagen Poiseuille's) - Hydraulic and Energy Gradient - Flow Through Pipes - Darcy -Weisback's Equation - Pipe Roughness - Friction Factor-Minor Losses - Flow Through Pipes in Series And in Parallel - Power Transmission - Dimensional Analysis - Buckingham's π Theorem- Applications - Similarity Laws and Models**.**

UNIT – IV: HYDRAULIC TURBINES L- 9 P-6

Hydro Turbines: Definition and Classifications - Pelton Turbine - Francis Turbine - Kaplan Turbine - Working Principles - Velocity Triangles - Work Done - Specific Speed - Efficiencies -Performance Curve for Turbines.

UNIT – V: HYDRAULIC PUMPS L- 9 P-6

Pumps- Classifications - Centrifugal Pump- Classifications, Working Principles, Priming, Velocity Triangles, Specific Speed, Efficiency and Performance Curves - Reciprocating Pump- Classification, Working Principles, Slip, Performance Curves and Work Saved by Air Vessels - Cavitations in Pumps – Working Principles of Gear Pump and Submersible Pump.

Total: 75 Periods

8. Practical

List of Experiments

1. Verification of Bernoulli's Theorem.
2. Determine the Coefficient ofDischarge ofgiven Orifice Meter / Venturimeter.
3. Determine the Coefficient of discharge of given Pitot tube.
4. Determine the Friction Factor ofFluid Flow by Major Loss / Minor loss.
5. Calculate the Rate ofFlow using Rotameter.
6. Conduct Experiment and Draw the Performance Characteristic Curves of Centrifugal Pump / Reciprocating Pump.
7. Conduct Experiment and Draw the Performance Characteristic Curves of Gear Pump /Jet Pump.
8. Conduct Experiment and Draw the Performance Characteristic Curves of Submersible Pump.
9. Conduct Experiment and Draw the Performance Characteristic Curves of Pelton Wheel Turbine.

10. Conduct Experiment and Draw the Performance Characteristics Curves of Francis Turbine.
11. Conduct Experiment and Draw the Performance Characteristic Curves of Kaplan Turbine.

Total = 30 Periods
TOTAL (45+30): 75periods

9. Text Books

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.
2. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, (7^{th} edition), Laxmi publications (P) Ltd., New Delhi, 2011.

10. References

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", S.Chand& Company Pvt. Ltd, 2014.
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, “Fluid Mechanics and Machinery”, 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011