SILVER OAK UNIVERSITY

College of Technology (01)

Diploma in Mechanical Engineering

Subject Name: Fluid Mechanics and Hydraulic machines

Subject Code: 1010122218

Semester: 3rd

Prerequisite: Zeal to learn the subject

Objective: The main objective of this course is to understand the fundamentals of the fluid mechanics such as fluid and flow properties, fluid behavior at rest and in motion and fundamental equations like mass, energy and momentum conservation of the fluid flow thereby developing an understanding of fluid dynamics in variety of fields.

Teaching and Examination Scheme:

Teaching Scheme Credits					Evaluation Scheme				Total Marks
					Theory		Practical		
L	T	P	Contact Hours	Credits	CIE (TH)	ESE (TH)	CIE (TH)	ESE (TH)	
4	0	2	6	5	40	60	20	30	150

Content:

Unit No.	Contents	Teaching Hours	Weightage %
1	**Fluids and Their Properties:** Introduction of fluid, fluid classifications, hypothesis of continuum, Shear stress in a moving fluid, molecular structure of material, fluid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitation, compressibility and the bulk modulus.	5	12
2	**Pressures and its measurement:** Types of Pressure, Pascal's law of pressure at a point, variation of pressure vertically in a fluid under gravity, equality of pressure at the same level in a static fluid, general equation for the variation of pressure due to gravity from a point to point in a static fluid, pressure and head, the hydrostatic paradox, pressure measurements using Manometers and mechanical gauges with simple numerical examples.	4	9
3	**Buoyancy & floatation:** buoyancy, equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacentre relative to the center of buoyancy.	4	9
4	**Motion of Fluid Particles and Streams:** Fluid flow, different types of flow, frames of reference, analyzing fluid flow, motion of a fluid particle, acceleration of a fluid particle, discharge and mean	3	7

	velocity, continuity of flow, continuity equations for 2-D and 3-D flow in Cartesian coordinates of system		
5	**The Energy Equation and its Application:** Momentum and fluid flow, Momentum equation for 2-D and 3-D flow along a stream line, momentum correction factor, Euler's equation of motion along a stream line, Mechanical energy of a flowing fluid – Bernoulli's theorem, kinetic energy correction factor, pitot tube, determination of volumetric flow rate via pitot tube, principle of venturimeter, pipe orifices, Rotameter, elementary theory of notches and weirs.	5	12
6	**Viscous and Turbulent Flow:** Reynolds' experiment, flow of viscous fluid through circular pipe-Hagen Poiseuille formula, flow of viscous fluid between two parallel fixed plates turbulent flow expression for coefficient of friction -Darchy Weishbach equation.	3	7
7	**Flow through pipes:** Major energy losses, Minor energy losses, Hydraulic gradient and total energy lines, Pipes in series and parallel, Equivalent pipes, Siphon, power transmission through pipe, Flow through nozzle at end of pipe, Water hammer in pipes.	3	7
8	**Impact of Jet and Hydraulic Turbines:** Force exerted on stationary flat and curved plates held normal, force exerted on moving plate held normal and on a plate when vane is moving in direction of jet, jet striking on curved vane tangentially at one tip and leaving at other end, classification of hydraulic turbines, impulse and reaction turbines, construction, working and analysis of Pelton, Francis and Kaplan turbines, draft tube, governing of the hydraulic turbines, cavitation, performance characteristics.	8	20
9	**Centrifugal Pumps:** Pump classification and selection criterion, velocity vector diagrams, pump losses and efficiencies, net positive suction head, pressure rise in impeller, characteristic curves, priming.	5	12
10	**Hydraulic Machines:** Hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic jack, hydraulic lift, hydraulic ram, fluid couplings, fluid torque converter and air lift pump.	2	5

Course Outcome:

Sr. No.	CO statement	Unit No
CO-1	Explain various fluid properties and behaviour of fluid in static and dynamic mode.	1,2,3
CO-2	To understand velocity, Acceleration of fluid particles and energy equation and its application	4,5
CO-3	Understand fundamentals of viscous flow, turbulent flow &flow through pipes	6,7
CO-4	Analyze theory of impact of jet and apply the same for hydraulic turbine.	8
CO-5	Evaluate performance of centrifugal pumps & understand different hydraulic device	9,10

Teaching & Learning Methodology:

1. Direct instruction
2. Kinesthetic learning
3. Flipped classroom
4. Personalized learning

List of Experiments:

1. To understand pressure measurement procedure and related instruments/devices.
2. To determine metacentric height by metacentric height apparatus
3. Verification of Bernoulli's theorem.
4. To measure the velocity of flow using Pitot tube.
5. To determine the Coefficient of discharge through different flow meters. (Any two out of Orifice meter, Venturi meter and Nozzle meter.)
6. To determine the Coefficient of discharge through open channel flow over a Notch. (Rectangular or V notch)
7. To determine the different types of flow Patterns by Reynolds's experiment
8. To verify Impulse-momentum principle for impact of jet on stationary vane.
9. Performance test on hydraulic turbine
10. Performance test on centrifugal pump

Major Equipment:

1. Different manometer & pressure gauge
2. Metacentric height apparatus
3. Test rig-comprising facilities to verify Bernoulli's theorem, to measure fluid flow by Venturimeter; nozzle; orifice meter, rota meter, "V" notch, pitot tube and major and minor head loss through pipes.
4. Reynolds's experiment test rig
5. Impact of jet apparatus,
6. Test rigs of Pelton, Francis and Kaplan turbine,
7. Test rigs of centrifugal pump

Books Recommended:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria & Sons
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan
3. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.
4. Theory and Applications of Fluid Mechanics by K. Subramanya, McGraw Education
5. Fluid Mechanics by Frank. M. White, McGraw Hill Education
6. Mechanics of Fluids by Shames, McGraw Hill Education

List of Open Source Software/learning website:

1. http://nptel.ac.in/, http://www.nfpa.com/