Model Question Paper-2 with effect from 2019-20 (CBCS Scheme)

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Fourth Semester B.E. Degree Examination
Fluid Mechanics And Machines

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module -1	*Bloom's Taxonomy Level	Marks
Q.01	a	Define the following properties of fluid with their SI units: i) Weight density ii) Dynamic viscosity iii) Surface tension	L1	6
	b	State and prove the Pascal's law	L2	6
	c	A 15cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10cm both cylinders are 25cm of height. The space between the cylinders is filled with liquid whose viscosity is unknown. If a torque of 12N-m is required to rotate the inner cylinder at 100rpm, determine the viscosity of the fluid.	L3	8
		OR		
Q.02	a	Derive an expression for total pressure force and depth of centre of pressure for an inclined plane surface submerged in liquid.	L2	8
	b	A pipe line which is 4m in diameter contains a gate valve. The pressure at the centre of the pipe is 19.6 N/cm^2. If the pipe is filled with oil of specific gravity 0.87, find the force exerted by the oil upon the gate and position of centre of pressure.	L3	8
	c	Derive the expression of pressure difference across two pipes are at same level using differential U-tube manometer connected between them.	L2	4
		Module-2		
Q. 03	a	Derive continuity equation for the 3-Dimenssional incompressible flow in Cartesian coordinates.	L2	8
	b	A fluid flow field is given by $V = (x^2y)i + (y^2z)j - (2xyz + yz^2)k$ prove that it is a case of possible steady incompressible fluid flow. Calculate velocity and acceleration at a point (2,1,3)	L3	6
	c	Distinguish between the following: i) Steady and Unsteady flow ii) Uniform and Non uniform flow iii) Laminar and Turbulent flow	L1	6
		OR		
Q.04	a	Derive Euler's equation of motion along a stream line and deduce it to Bernoulli's equation with assumptions made.	L2	8
	b	Water is flowing through a pipe having diameter 300mm and 200mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525N/cm^2 and the pressure at the upper end is 9.81N/cm^2. Determine the difference in datum head, If the rate of flow through the pipe is 40litres/sec.	L3	6
	c	A horizontal pipe, through which water is flowing, is having diameters 20cm and 10cm at the cross sections 1 and 2 respectively. The velocity of water at section 1 is given as 5m/s. find the kinetic head at sections 1 and 2 and also find discharge.	L2	6
		Module-3		

Q. 05	a	What is dimensional homogeneity? Explain with examples	L1	4
	b	What are the methods of dimensional analysis? Describe Rayleigh's method of dimensional analysis.	L2	6
	c	The rate of discharge Q of a centrifugal pump is dependent upon density of the fluid ρ, pump speed N in rpm, Diameter of the impeller D, and pressure P, and viscosity of the fluid μ. Using Buckingham's π-theorem, Show that $Q = ND^3\Phi\left[\frac{P}{\rho N^2D^2}, \frac{\mu}{\rho ND^2}\right]$	L3	10
		OR		
Q. 06	a	Derive an expression for discharge through a triangular notch.	L2	8
	b	A horizontal Venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of water. The pressure at inlet is 17.65N/cm^2 and the vacuum pressure at the throat is 30cm of mercury. Find the discharge of water through Venturimeter. Take C_d =0.98.	L3	8
	c	Find the velocity of flow of an oil through pipe, when difference of mercury level in a differential U-tube manometer connected to the two tappingsof the Pitot tube is 100mm. take coefficient of pitot tube 0.98 and Sp.gr. = 0.8.	L3	4
		Module-4		
Q. 07	a	Define Turbomachine. With a neat sketch, explain the parts of Turbomachine.	L1	8
	b	Differentiate between Positive Displacement Machine and Turbomachine.	L2	8
	c	Classify the Turbomachines.	L2	4
		OR		
Q. 08	a	With necessary velocity triangles, Derive an expression of alternative form of Euler's turbine equation and explain each component.	L3	8
	b	Define utilization factor and derive the relation between the degree of reaction and utilization factor for a turbine.	L3	6
	c	Draw the inlet and outlet velocity triangles for the following cases i) The blades are axial at Inlet and the fluid leaves axially ii) The fluid enters radially and the blades are radial at outlet	L2	6
		Module-5		
Q. 09	a	With a neat sketch explain the working of Kaplan turbine.	L2	8
	b	Pelton wheel designed for the following data: power to be developed=5880kW, Net head available=300m, Speed = 550rpm, ratio of jet diameter to wheel diameter = 1/10 and overall efficiency = 85%. Find the number of jet, diameter of the wheel and quantity of water required. Assume C_J = 0.98, Φ = 0.46.	L3	8
	c	What is the draft tube and what are its functions?	L1	4
		OR		
Q. 10	a	Derive the equation for maximum blade efficiency of Impulse steam turbine with equiangular blades	L3	8
	b	Define compounding of steam turbine. Explain any method of compounding with sketch	L2	6
	c	The following data refers to a particular stage of a Parsons reaction turbine. Speed of the turbine =1500 RPM, Mean diameter of the rotor = 1m, Stage efficiency =0.8, Blade outlet angle =20°, Speed ratio =0.7, Determine the available isentropic enthalpy drop in stage.	L3	6

*****Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.