Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

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Fourth Semester B.E. Degree Examination

Fluid Mechanics

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 Following terms with SI Units: i) Surface Tension ii) Kinematic Viscosity iii) Compressibility iv) Capillarity.	L1, L2	08
	B	An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve .The diameter of the shaft is 0.5 m and it rotates at 200 rpm. Calculate the power lost in oil for a sleeve length of 100 mm. The thickness of oil film is 1.0 mm.	L3, L4	08
	C	A Simple U-tube manometer containing mercury is connected to a pipe in which a fluid of Sp. gravity 0.8 and having vacuum pressure is flowing. The other end of manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in two limbs is 40 cm and the height of fluid in the left from the centre of pipe is 15cm below.	L3, L4	04
		OR		
Q.02	A	Derive an Expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid.	L1, L2	08
	B	A Pipe line which is 4m in diameter contains a gate valve. The pressure at the centre of the pipe line is 19.6 N/cm^2. If the pipe is filled with oil of sp. gr. 0.87, find the force exerted by the oil upon the gate and position of centre of pressure.	L1, L2	08
	C	Define Following terms: i) Total Pressure ii) Centre of Pressure	L3, L4	04
		Module-2		
Q. 03	a	Define: 1) Buoyancy ii) Centre of Buoyancy iii) Meta-centre iv) Meta-centric height.	L1, L2	08
	b	A uniform body of size 3 m long × 2 m wide ×1 m deep floats in water. What is the weight of the body if depth of immersion is 0.8 m? Determine the meta-centric height also.	L3, L4	08
	c	Find the volume of the water displaced and position of centre of buoyancy for a wooden block of width 2.5 m and of depth 1.5 m, when it floats horizontally in water. The density of wooden block is 650 kg/m^3 and its length 6.0 m.	L3, L4	04
		OR		
Q.04	a	Derive the continuity equation for the 3-Dimensional flow in Cartesian co-ordinates.	L1, L2	08
	b	Differentiate between: i) Stream function and velocity potential function ii) Steam line and streak line iii) Rotational and irrotational flow iv) Laminar and turbulent flow	L1, L2	08
	c	Stream function is given by $\Psi=3xy$. Determine whether the flow is possible or not.	L3, L4	04
		Module-3		
Q. 05	a	Derive Euler's equation of motion along a stream line and deduce Bernoulli's equation. State the assumptions made.	L1, L2	08
	b	The inlet and throat diameter of a horizontal veturimeter are 30 cm and 10 cm respectively. The liquid flowing through the veturimeter is water. The pressure	L3, L4	08

		intensity at inlet is 13.734 N/cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of C_d for the veturimeter.		
	c	Determine the height of a rectangular notch of length 6m to be built across a rectangular channel. The maximum depth of water on the upstream side of rectangular notch is 1.8 m and discharge is 2000 litres/s. Take C_d=0.6 and neglect end contractions.	L3, L4	04
		OR		
Q. 06	a	Derive Hagen-Poiseuille's equation for laminar flow through a circular pipe.	L1, L2	08
	b	A fluid of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100mm. The maximum shear stress at pipe wall is given as 196.2N/m^2. Find i) The pressure gradient ii) Average velocity iii) Reynold's number of the flow.	L3, L4	08
	c	Define Reynold's number. What is significance?	L1, L2	04
		Module-4		
Q. 07	a	Define the drag force and lift force. Also derive their expressions.	L1, L2	08
	b	Define: i) Laminar boundary layer ii) Turbulent boundary layer iii) Laminar sub-layer iv) Boundary layer thickness	L1, L2	08
	c	A man weighing 882.9 N descends to the ground from an aeroplane with the help of a parachute against the resistance of air. The velocity with which the parachute, which is hemispherical in shape, comes down is 20 m/s. Find the diameter of the parachute. Assume C_D= 0.5 and density of air=1.25 kg/m^3.	L3, L4	04
		OR		
Q. 08	a	The frictional torque T of a disc diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T = D^5N^2\rho\Phi\left[\frac{\mu}{D^2N\rho}\right]$. Prove this by the method of dimensions.	L3, L4	08
	b	Define Similitude and Explain the following: i) Geometric similarity ii) Kinematic similarity iii) Dynamic similarity	L1, L2	08
	c	Explain dimensional homogeneity with example.	L1, L2	04
		Module-5		
Q. 09	a	Define stagnation properties. Obtain an expression for stagnation pressure of a compressible fluid in terms of Mach number and pressure.	L1, L2	08
	b	A projectile travel in air of pressure 10.1043 N/cm^2 at 10^{o}C at a speed of 1500 km/hour. Find the Mach number and the Mach angle. Take k=1.4 and R=287 J/kg K.	L3, L4	08
	c	Define: i) Mach number ii) Mach cone iii) Zone of action iv) Super-Sonic flow	L1, L2	04
		OR		
Q. 10	a	What is CFD? Mention the applications of CFD.	L1, L2	08
	b	What are the advantages and disadvantages of CFD?	L1, L2	08
	c	Explain the necessity of CFD.	L1, L2	04

*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.