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

USN | | | | | | | | | | |

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) Weight density ii) Dynamic Viscosity iii) Bulk Modulus iv) Capillarity.	L1, L2	08
	b	An oil of thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m × 0.9 m slides down an inclined plane having an inclination of 20^o with the horizontal. The weight of square plate is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/s. Find the kinematic viscosity of oil specific gravity of the oil is 0.7.	L3, L4	08
	c	Determine the specific gravity of a fluid having viscosity 0.05 poise and kinematic viscosity of 0.035 stokes.	L3, L4	04
		OR		
Q.02	a	Derive an Expression for total pressure force and depth of pressure for a vertical surface submerged in water.	L1, L2	08
	b	Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4 m and altitude 4 m when it is immersed vertically in an oil of sp.gr. 0.9. The base of the plate coincides with the free surface of oil.	L1, L2	08
	c	A rectangular sluice gate is situated on the vertical wall of a lock. The vertical side of the sluice is'd' meters in length and depth of centroid of the area is 'p' meters below the water surface. Prove that the depth of pressure is equal to $\left(p + \frac{d^2}{12p}\right)$	L3, L4	04
		Module-2		
Q. 03	a	Explain: i) Method to find the Meta-centric height experimentally. ii) Meta-centre	L1, L2	08
	b	A block of wood of specific gravity 0.7 floats in water. Determine the meta-centric height of the block if its size is 2 m × 1 m × 0.8 m.	L3, L4	08
	c	Find the density of a metallic body which floats at the interface of mercury of sp.gr. 13.6 And water such that 40% of its volume is sub-merged in mercury and 60% in water.	L3, L4	04
		OR		
Q.04	a	Write the expression for acceleration of a fluid in x, y and z directions. Differentiate between local and convective acceleration.	L1, L2	08
	b	If for a two- dimensional potential flow, the velocity potential is given by $\Phi = x(2y - 1)$ Determine the velocity at the point p (4, 5) .Determine also the value of stream function Ψ at the point P.	L3, L4	08
	c	Explain the methods of describing fluid flow.	L1, L2	04
		Module-3		
Q. 05	a	What is a veturimeter? Derive an expression for the discharge through a veturimeter.	L1, L2	08
	b	An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the flow rate of flow of oil of sp. gr. 0.9 when the co-efficient of	L3, L4	08

		discharge of the orifice meter=0.64.		
	c	Find the velocity of the flow of an oil through a pipe, when the difference of mercury level in a differential U-tube manometer connected to the two tappings of the pitot-tube is 100 mm. Take co-efficient of pitot-tube 0.98 and sp. gr. of oil= 0.8	L3, L4	04
		OR		
Q. 06	a	Define Reynolds number. What is its significance? List the characteristics of laminar flow.	L1, L2	08
	b	Oil is to be transported from a tanker to the shore at the rate of 5 litre/sec, using a 300 mm diameter pipe for 20 km length. If μ = 0.1 N-m/s^2 and ρ = 900 kg/m^3 for the oil. Calculate power required to maintain the flow.	L3, L4	08
	c	Water at 15^{o}C flows between two parallel plates at a distance of 1.6 mm apart. Determine : i) Maximum velocity ii) Pressure loss per unit length iii) Shear stress at the plate if the average velocity is 0.2 m/s. Viscosity of water at 15 ^{o}C is 0.01 poise . Take unit width of the plate.	L3, L4	04
		Module-4		
Q. 07	a	A kite weighing 7.848 N has an effective area of 0.8 m^2. It is maintained in air at an angle of 10^o to the horizontal. The string attached to the kite makes an angle of 45^o to the horizontal and at this position the value of co-efficient of drag and lift are 0.6 and 0.8 respectively. Find the speed of the wind and the tension in the string. Take the density of air as 1.25 kg/m^3	L1, L2	08
	b	Derive an expression for displacement thickness and momentum thickness of a flow over a plate.	L1, L2	08
	c	Find the difference in drag force exerted on a flat plate of size 2 m × 2 m when the plate is moving at a speed of 4 m/s normal to its plane in: i) Water ii) air of density 1.24 kg/m^3, Co-efficient of drag is given as 1.15.	L3, L4	04
		OR		
Q. 08	a	Show by method of dimensional analysis that, for a screw propeller, the relation between the thrust F, torque T, diameter D, speed of travel U, speed of rotation N, density ρ and viscosity μ may be put in the form $F = \rho D^2 U^2 \Phi \left[\frac{\rho D^3 U^2}{T}, \frac{DN}{U}, \frac{\rho UD}{\mu}, \right]$ [Hint: Take D, U, and ρ as repeating variables]	L3, L4	08
	b	Explain different types of similitude.	L1, L2	08
	c	Explain Rayleigh method of the dimensional analysis.	L1, L2	04
		Module-5		
Q. 09	a	Derive an expression for velocity of sound in a fluid.	L1, L2	08
	b	An aeroplane flying at a height of 15km, where the temperature is -50^{o}C The speed of the plane is corresponding to Mach numbers is 2.0. Assuming k=1.4 and R=287J/kg K, find the speed of the plane.	L3, L4	08
	c	Define Mach number. What is the significance of Mach number in Compressible fluid flows?	L1, L2	04
		OR		
Q. 10	a	Explain Necessity and limitations of CFD.	L1, L2	08
	b	Write short essay on the engineering application of CFD.	L1, L2	08
	c	Write a short note on philosophy behind 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.