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December 2023 (REEXAM)

SY B.TECH (SEMESTER - I)

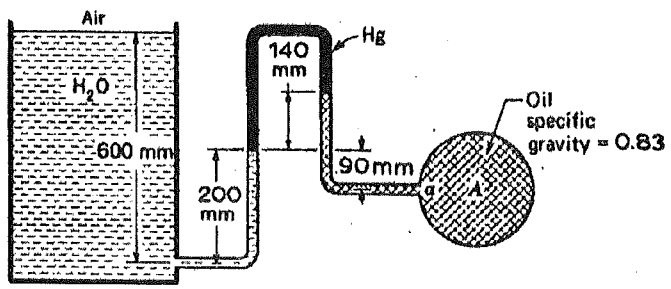
COURSE NAME: Fluid Mechanics Branch: Civil Engineering **COURSE CODE:CVUA21204**

(PATTERN 2020)

Time: [2 Hrs] **[Max. Marks: 60]**

(*) Instructions to candidates:

1) **Figures to the right indicate full marks.**
2) **Use of scientific calculator is allowed**
3) **Use suitable data wherever required**
4) **All questions are compulsory. Solve any two sub questions each from each Question 1 ,2, 3,4,5, and 6 respectively**

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) At a depth of 7 km in the ocean, the pressure is 71.6 MPa. Assume a specific weight at the surface of 10.05 kN/m^3 and an average bulk modulus of elasticity of 2.34 GPa for that pressure range. Find (a) the change in specific volume between the surface and 7 km; (b) the specific volume at 7 km; (c) the specific weight at 7 km.	[5]	1	Apply
	b) A vertical gap 1.2 cm wide infinite extent contains fluid of viscosity 1 N-s/m^2 and specific gravity 0.9. A metallic plate 1 m x 1m x 0.2 cm is lifted up with a constant velocity of 0.2 m/s through the gap. If the plate is at a distance of 0.4 cm from one of the plane surfaces of the gap, find the vertical force required. Weight of the plate is 50 N.	[5]	1	Apply
	c) Derive equation for pressure inside a soap bubble and liquid jet			
Q2	a) For the set up shown below, Calculate the absolute pressure "A". Assume standard atmosphereic pressure as 101.3 kPa. 	[5]	2	Apply
	b) A rectangular plane surface 2 m wide and 4 m deep lies in water in such a way that its plane makes an angle of 30° with the free surface of water. Determine the total pressure and the position of centre of pressure when the upper edge is 2 m below the free	[5]	2	Apply

	surface. c) Determine the volume of the water displaced 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.	[5]	2	Apply
Q3.	a) Derive continuity equation for steady uniform flow of incompressible fluid in 3 D cartesian coordinate system	[5]	3	Apply
	b) The diameters of a pipe at the sections 1 and 2 are 10 cm and 15 cm respectively. Find the discharge through the pipe if the velocity of water flowing through the pipe at section 1 is 5 m/s.	[5]	3	Apply
	c) For a two-dimensional potential flow, the velocity potential is given by $\phi = X(2y - 1)$. Determine the value of stream function ψ at the point P (4,5).	[5]	3	Apply
Q.4	a) A vertical pipe carrying oil of sp. gr. 0.8 tapers uniformly from 20 cm diameter at the lower section to 10 cm diameter at the upper section. The vertical distance between the sections is 1 m. The pressure gauge installed at the lower and upper sections read 6 N/cm^2 and 5 N/ cm^2 respectively when the discharge of oil is 30 litre/sec Calculate the loss of head between the sections. Determine the direction of flow also.	[5]	4	Apply
	b) Derive equation of discharge for flow through orifice	[5]	4	Apply
	c) An orifice is to be used to indicate the flow rate of water in a 30 mm diameter line. The orifice diameter is 15 mm. What pressure reading will be experienced on the orifice for a line flow velocity of 3.2 m/s ? What would be the flow rate for a pressure reading of twice this value? Assume orifice discharge coefficient = 0.604 for a flow of velocity of 3.2 m/s and 0.601 in the latter case.	[5]	4	Apply
Q.5	a) Prove that for steady laminar flow through circular pipe velocity distribution is parabolic. Determine the maximum velocity	[5]	5	Apply
	b) For the velocity Profile $\frac{u}{U} = (\frac{y}{\delta})^n$, calculate the displacement thickness, momentum thickness	[5]	5	Apply
	c) A plate 3 m x 1.5 m is held horizontally in water moving at 1.25 m/s parallel to its length. If the flow in the boundary layer is laminar at the leading edge of the plate, i) Find the distance from the leading edge where the boundary layer flow changes from laminar to turbulent. ii) Find the thickness of the boundary layer at this section.	[5]	5	Apply
Q.6)	a) Derive Dupit's equation for flow through parallel pipes	[5]	6	Apply
	b) Derive Darcy Weisbach equation for flow through pipe	[5]	6	Apply
	c) A compound piping system consists of 1800 m of 0.50 m, 1200 m of 0.40 m and 600 m of 0.30 m cast iron pipes connected in series. Convert the system to (a) an equivalent length of 0.40 m pipe, and (b) and equivalent size pipe 3600 m long	[5]	6	Apply