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Reg. No. : | | | | | | | | | | |

Question Paper Code: 53105

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022

Third Semester

Civil Engineering

15UCE305 - FLUID MECHANICS

(Regulation 2015)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. The surface tension in a soap bubble of 40mm diameter, when the inside pressure is 2.5N/m^2 above atmospheric pressure IS — CO1- R

   (a) 0.0025N/m (b) 0.025N/m (c) 0.25N/m (d) 2.5N/m

2. Unit for surface tension — CO2- R

   (a) N/m (b) Kg/mm (c) Kn/m (d) Kg/m

3. Which of the following boundary conditions exist at the wall (y=0) in a boundary layer — CO3- R

   (a) u=U (b) dp/dx= -ve (c) τ_o =0 (d) u=0,v=0

4. For maximum transmission of power through the pipeline with total head H, the head loss due to friction h_f is given by h_f = — CO4- R

   (a) H/3 (b) 2H/3 (c) H/2 (d) H/10

5. Dynamic similarity exists between two fluid flows when at corresponding points there are — CO5- R

   (a) Geometric similarity and similarity of forces involved

   (b) Kinematic similarity and dynamic similarity

   (c) Interaction of inertia and viscous forces

   (d) Interaction between inertia, viscus and pressure forces

PART – B (5 x 3= 15 Marks)

6.	Differentiate Newtonian and non-Newtonian fluids.	CO1- R	
7.	What are the types of fluid flow in kinematics?	CO2- R	
8.	What is boundary layer? Why it is significant.	CO3- R	
9.	What are the minor energy losses in flow through pipe?	CO4- R	
10.	State Buckingham's π theorem. How repeating variables are selected?	CO5- R	

PART – C (5 x 16= 80 Marks)

11.	(a)	The dynamics viscosity of oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 r.p.m. calculate the power lost in the bearing for a sleeve length of 90mm. the thickness of oil film is 1.5 mm.	CO1- App	(16)
		Or		
	(b)	A U- Tube manometer is used to measure the pressure of water in the pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in main line, if the difference in level of mercury in the limbs of U- tube is 10 cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m^2, calculate the new difference in the level of mercury. Sketch the arrangements in both cases.	CO1- App	(16)
12.	(a)	Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5m diameter. At C, the pipe branches. Branch CD is .8m in diameter ad carries one-third of the flow in AB. The flow velocity in branch CE is 2.5m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE.	CO2- App	(16)
		Or		
	(b)	A pipe line carrying oil of specific gravity 0.87, changes in diameter from 200 mm at a position A to 500mm at a position B which is 4 meters at a higher level. If the pressure at A and B are 9.81 N/cm^2 and 5.886 N/cm^2 respectively and the discharge is LPS determine the loss of head and direction of flow.	CO2- App	(16)
13.	(a)	(i) Obtain an expression for boundary shear stress in terms of momentum thickness.	CO3 - Ana	(10)
		(ii) What is meant by boundary layer separation? Highlight the effect of pressure gradient on boundary layer separation.	CO3 - Ana	(6)
		Or		

	(b)	Find the displacement thickness, momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U = 1.5(y/\delta) - 0.5(y/\delta)$ 2, where u is the velocity at a distance y from the plate and $u = U$ at $y = \delta$, Where δ = boundary layer thickness. Also find the ratio of displacement thickness to momentum thickness.	CO3- Ana	(16)
14.	(a)	Glycerine of viscosity 0.9 Ns/m2 and density 1260 kg/m3 is pumped along a horizontal pipe 6.5 cm long of diameter 0.014 m at a flow rate of 1.8 LPM. Determine the flow Reynolds number and verify whether the flow is laminar or turbulent. Calculate the pressure loss in the pipe due to frictional effects and calculate the maximum flow rate for laminar flow conditions to prevail.	CO4- App	(16)
		Or		
	(b)	The rate of flow through a horizontal pipe is 0.25 m3/s. The diameter of the pipe which is 200mm is suddenly enlarged to 400mm. The pressure intensity in the smaller pipe is 11.772 N/cm2. Determine (i) Loss of head due to sudden enlargement. (ii) Pressure intensity in large pipe. (iii) Power lost due to enlargement.	CO4- App	(16)
15.	(a)	The resisting force of (R) of a supersonic flight can be considered as dependent upon the length of aircraft ` l', velocity 'V', air viscosity 'μ', air density 'ρ', and bulk modulus of air 'k'. Derive the functional relationship between these variables and the resisting force.	CO5- Ana	(16)
		Or		
	(b)	(i) Explain in detail the Reynold's law of similitude and Froude's law of similitude.	CO5- Ana	(6)
		(ii) The pressure drop in an aero-plane model of size [1/10] of its prototype is 80 N/cm^2. The model is tested in water. Find the corresponding pressure drop in the prototype. Take density of air and water are 1.24 kg/m^3 and 1000 kg/m3. The viscosity of air and water are 0.000018 Ns/m^2 and 0.001 Ns/m2 respectively.	CO5- Ana	(10)

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