P P SAVANI UNIVERSITY

Fourth Semester of B. Tech. Examination

May 2022

SEME2060 Fluid Mechanics

23.05.2022, Monday **Time: 09:00 a.m. To 11:30 a.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Make suitable assumptions and draw neat figures wherever required.
3. Use of scientific calculator is allowed.

SECTION – I

Q – 1 (a) Explain the classification of fluids in detail. **[05]**

Q - 2 (a) Define pressure. Obtain an expression for the pressure intensity at a point in a fluid. **[05]**

Q - 2 (b) The right limb of a simple u-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of dp.gr 0.9 is flowing. The center of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm. **[05]**

OR

Q - 2 (a) Derive an expression for total pressure and position of pressure when Inclined plane surface submerged in the liquid. **[05]**

Q - 2 (b) A rectangular plane surface 2 m wide and 3 m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and (a) Coincides with water surface (b) 2.5m below the free water surface. **[05]**

Q - 3 (a) Write a statement of continuity equation and derive the expression for three dimensional Cartesian coordinates. **[05]**

Q - 3 (b) Explain in detail velocity potential function and stream function. **[05]**

OR

Q - 3 (a) How will you determine the meta centric height of a floating body experimentally? Explain with neat sketch. **[05]**

Q - 3 (b) A solid cylinder of diameter 4 m has a height of 3 m. Find the meta-centric height of cylinder when it is floating in water with its axis vertical. The sp.gr of the cylinder=0.6. **[05]**

Q – 4 **Attempt Any One.** **[04]**

(i) What is Pitot-tube? Derive velocity equation at any point Velocity $\mathbf{V=C_v\sqrt{2gh}}$.

(ii) Derive Bernoulli's equation from Euler's equation. Also state assumptions and practical applications of it.

SECTION – II

Q – 1 (a) The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by, **[07]**

$$T = D^5N^2\rho\left[\frac{\mu}{D^2N\rho}\right]$$

Q – 1 (b) What do you mean by Hydraulic Gradient Line and Total Gradient Line? **[03]**

Q – 2 (a)	Derive the Hagen – Poiseuille equation for laminar flow in the circular pipe.	**[05]**
Q – 2 (b)	An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 liters/s. Find the head lost due to friction for a 500 m length of pipe. Also find the power required to maintain the flow. Take $f = 0.079/(Re)^{1/4}$	**[05]**

OR

Q – 2 (a)	Derive an expression for the loss of head due to friction in pipes.	**[05]**
Q – 2 (b)	A crude oil of viscosity 0.9 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 120 mm and length 12 m. calculate the difference of pressure at the two ends of the pipe, if 785 N of the oil is collected in tank in 25 seconds.	**[05]**

Q – 3	Define Following. a) Dimensional Homogeneity b) Summit c) Syphon d) Secondary Variable e) Kinematic Similarities f) Model	**[05]**

OR

Q – 3	Derive the expressions for discharge over (i) Rectangular notch (ii) Triangular notch	**[05]**

Q - 4	**Attempt any one.**	**[05]**
(i)	Explain the Concept of Boundary Layer.	
(ii)	Define Following. a) Boundary Layer Thickness b) Displacement Thickness c) Momentum Thickness d) Energy Thickness	

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