Hall Ticket No | | | | | | | | | | |

Question Paper Code: ACEC03

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024

Regulation: UG20

FLUID MECHANICS

Time: 3 Hours **(CIVIL ENGINEERING)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) State Newton's law of viscosity. Explain in detail about the effects of surface tension by citing practical applications. [BL: Understand| CO: 1|Marks: 7]

   (b) A clean tube of diameter 2.5 mm is immersed in a liquid with a coefficient of surface tension as 0.4 N/m. The angle of the liquid with the glass can be assumed to be 135°. The density of the liquid = 13600 kg/m^3 . What would be the level of the liquid in the tube relative to the free surface of the liquid inside the tube. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Write about centre of pressure. Derive an expression for centre of pressure for a vertically submerged surface. [BL: Understand| CO: 2|Marks: 7]

   (b) A rectangular plate 3 m long and 1 m wide is immersed vertically in water in such a way that its 3 m side is parallel to the water surfaces and is 1 m below it. Find

   i) Total pressure on the plate

   ii) Position of centre of pressure. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) List different types of fluid flow. Obtain an expression for 2D flow continuity equation. [BL: Understand| CO: 3|Marks: 7]

   (b) A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in the pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s. [BL: Apply| CO: 3|Marks: 7]

4. (a) Discuss about irrotational flow. Show that a Laplace equation is satisfied in potential flows stream function and velocity potential function [BL: Understand| CO: 4|Marks: 7]

   (b) The velocity vector in a fluid flow is V= $4x^3$i - $10x^2$yj + 2tk. Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time t=1. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Name the different forces present in a fluid flow. Derive Euler's equation of motion along a stream line for an ideal fluid. [BL: Understand| CO: 5|Marks: 7]

(b) Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43N/cm^3 (gauge) and with mean velocity of 2.0 m/s. Find the total head or total energy per unit weight of the water at a cross section which is 5 m above the datum line. [BL: Apply| CO: 5|Marks: 7].

6. (a) Differentiate between the pitot tube and pitot static tube. Describe in detail about the pressure force on a curved section of pipe. [BL: Understand| CO: 5|Marks: 7]

(b) The water is flowing through a tapering pipe having diameters 300 mm and 150 mm at a section 1 and 2 respectively. The discharge through the pipe is 40 liters/sec. The section 1 is about 10 m above datum and section 2 is 6 m above datum. Find the intensity of pressure at section 2 if that at section 1 is 400 kN/m^2. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Develop the expression for head loss in pipes due to friction- Darcy - Weisbach equation. [BL: Understand| CO: 6|Marks: 7]

(b) The pressure intensities in the large and small pipe are given as 13.734 N/cm^2 and 11.772 N/cm^2. Find the loss of head due to contraction if cc=0.62. Also determine the rate of flow of water. [BL: Apply| CO: 6|Marks: 7]

8. (a) State the importance of Hardy cross method. Enumerate all the minor losses in the pipes with their formulas to estimate their magnitude. [BL: Understand| CO: 6|Marks: 7]

(b) The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe which is 200mm is suddenly enlarged to 400mm. Determine loss of head due to sudden enlargement. [BL: Apply| CO: 6|Marks: 7]

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