Code No: 153AX

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, March - 2022

FLUID MECHANICS

(Civil Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

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1.a) Name the different types of manometers and explain with a neat sketch how the pressure is measured by a differential manometer?

b) A triangle plate of 1.2 m base 1.8 m altitude is immersed in water. The plane of the plate is inclined at 35^0 with free water surface and the base is parallel to and at a depth of 2.5 m from water surface. Find the total pressure on the plate and the position of center pressure. [7+8]

2.a) Explain the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid.

b) A plate having an area of 0.85 m^2 is sliding down the inclined plate at 35^0 to the horizontal with a velocity of 0.55 m/s. There is a cushion of fluid 2.2 mm thick between the plane and the plate. Find the viscosity of the fluid if the weight of the plate is 350 N. [7+8]

3.a) Define the stream function and clearly bring out its physical significance. Enumerate some of the salient features of the stream function?

b) Water flows in a circular pipe. At one section the diameter is 0.3 m the static pressure is 280 kPa gauge, the velocity is 3.2 m/s and the elevation is 10 m above ground level. The elevation at a section downstream is 0 m and the pipe diameter is 0.25 m. Find the gauge pressure at the downstream section. Frictional effect may be neglected. Assume density of water to be 998 kg/m^3. [7+8]

4.a) Derive the Euler's equation of motion for steady flow along a stream.

b) Define momentum equation and its applications in detail. [8+7]

5.a) What do you understand by Velocity of approach? Find an expression for the discharge over a rectangular weir with velocity of approach?

b) A 45^0 reducing bend is connected to a pipe line, the diameters at the inlet and outlet of the bend being 650 mm and 320 mm respectively. Find the force exerted by bend on water if the intensity of pressure at the inlet to bend is 7.989 N/cm^2 and rate of flow of water is 650 litres/s. [7+8]

6.a) Find an expression for the discharge over a triangular notch and write what the advantages over rectangular notch?

b) A venturimeter has a diameter of 0.25 m at the inlet and 0.12 m diameter at the throat. It is fitted in a horizontal pipeline to measure the flow of oil of specific gravity 0.85. If 6900 kg of oil is collected in 2 minutes and the difference of levels in the U-tube differential manometer reads 0.285m Hg, then determine the discharge coefficient for the pipe venturimeter. Take specific gravity of mercury as 13.6. [7+8]

7.a) Define 'Hydraulic gradient line' and 'Total energy line'. The cross section of a pipe carrying a given discharge is suddenly enlarged. What would be the ratio of the two diameters of the pipe if the magnitude of the loss of head at this change of section is same irrespective of the direction of flow? Assume CC = 0.64.

b) Determine the loss of head due to friction in pipes by using (i) Darcy formula (ii) Chezy's formula? [7+8]

8.a) Define physically and mathematically the concept of displacement, momentum and energy thickness of a boundary layer.

b) Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow? [7+8]

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