

Please check that this question paper contains 9 questions and 2 printed pages within first ten

Total No. of Questions: 09]

[Total No. of Pages: 02]

Uni. Roll No.

Program: B.Tech. (Batch 2018 onward)

Semester: 3rd.

MORNING

Name of Subject: Fluid Mechanics

12 MAY 2023

Subject Code: PCCE-103.

Paper ID: 16022

Scientific calculator is Allowed

Detail of allowed codes/charts/tables etc. NA

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

- 1) Parts A and B are compulsory
- 2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
- 3) Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

- a) If the specific gravity of oil is 0.85, Calculate oil mass density.
- b) What are the difference between pipe flow and Open Channel flow.
- c) Define meta centre and its importance.
- d) What is Hydraulic Jump. Write its elements.
- e) If the water level in a piezometric tube is 40cm. What will be hydraulic pressure in Pascal.
- f) If a cube of 40cm side is half immersed in water, Calculate the Buoyant force acting on cube.

Part – B

[Marks: 04 each]

Q2.State Buckingham's π theorem with example.

Q3. Given that the unit discharge in a rectangular channel is $18 \text{ m}^3/\text{sec}$ and that the head loss across a hydraulic jump that forms in this channel is 1.1 m. Estimate the pre-jump and post-jump depths.

Q4. State the Bernoulli's theorem. Discuss the assumptions made in theorem and list out some engineering applications.

- Q5. A U-tube mercury differential manometer is used to measure the difference of pressure between inlet throat of a venturimeter placed with its axis horizontal in a pipeline. Calculate the difference in pressure between inlet and throat when the manometer reading is 250 mm and water flows through the pipeline.
- Q6. Verify whether the following functions are valid potential functions:
(i) $\phi = A(x^2 - y^2)$ (ii) $\phi = A \cos x$
- Q7. The water is flowing through a tapering pipe having diameters 300 mm and 150 mm at sections 1 and 2 respectively. The discharge through the pipe is 40 litres/sec. The section 1 is 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/m².

Part – C**[Marks: 12 each]**

- Q8. A trapezoidal channel with side slope of 1:1 has to be designed to convey 10 m³/s at a velocity of 2 m/s, so that the amount of concrete lining for the bed and sides is minimum.
- (i) Calculate the area of lining required for one meter length of the canal.
(ii) If the rugosity co-efficient $N=0.015$, calculate the bed slope of the canal for the uniform flow.

OR

The velocity distribution of flow over a plate is parabolic with vertex 30 cm from the plate, where the velocity is 180 cm/s. If the velocity of fluid is 0.9 N.s/m². Find the velocity gradient and shear stresses at a distance of 0, 15cm and 30cm from the plate.

- Q9. Oil with a free stream velocity of 2 m/sec flows over a thin plates 2 m wide and 2 m long. Calculate the boundary layer thickness and the shear stress at the trailing end point and determine the total surface resistance of the plate. Take specific gravity as 0.86 and kinematic viscosity as 10⁻⁵ m²/sec.

OR

A sluice gate discharges water into horizontal rectangular channel with a velocity of 10 m/s and the depth of flow of 1m. Determine the depth of flow of water after the jump and consequent loss in total head.
