S. E. (Sem-IV) (C-Scheme) (Mechanical) (Dec-2025)
Q. P. Code : 95481
Date : 19/12/2025

(3 Hours) [Total Marks: 80]

N.B.: (1) **Question No.1 is Compulsory.**
(2) Attempt any three Questions out of remaining five questions.
(3) Figures to the right indicate full marks.
(4) Assume any suitable data if necessary and justify the same.

Q1 **Solve any FOUR**

A) Explain Classification of fluid flow — 5

B) State and derive Hydrostatic law — 5

C) Explain Orifice meter and Pitot tube in detail with neat sketch — 5

D) A piston 9.95 cm in diameter works in a cylinder 10 cm diameter and 12 cm long. The space between the two is filled with an oil of viscosity 0.5 poise. Calculate the speed of the piston through the cylinder under the action of an axial force of 5 N. — 5

E) Describe boundary layer separation and how to control boundary layer separation — 5

Q2 A) An Inclined rectangular Sluice gate AB, 1.2m x 5 m size as shown in fig. is installed to control the discharge of water. The end A is hinged. Determine the force normal to the gate applied at B to open it. — 10
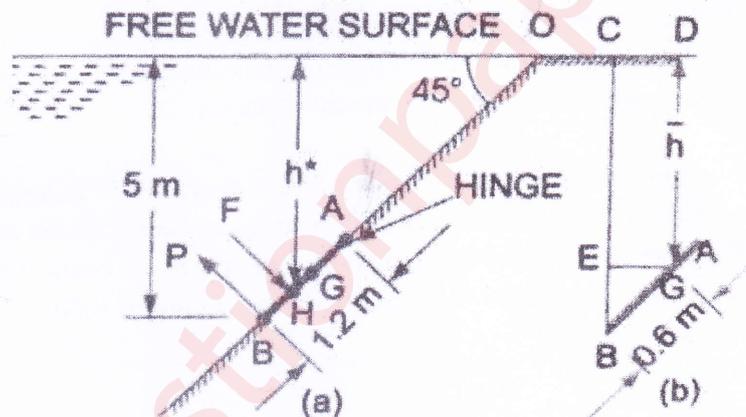
B) Derive the Bernoulli's Theorem and state its assumption. — 10

Q3 A) In a two dimensional incompressible flow, the fluid velocity components are given by $u = x - 4y$ and $v = -y - 4x$. Show that velocity potential exists and determine its form. Find also the stream function. — 10

B) Derive an expression for velocity distribution, discharge per unit width and shear stress when laminar flow between two parallel plates in which one plate moving and other at rest (Couette flow). — 10

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Q4 A) Using the laminar boundary velocity distribution: 10

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - 2\left(\frac{y}{\delta}\right)^3 + \left(\frac{y}{\delta}\right)^4$$

(i) Determine boundary layer thickness in terms of Re
(ii) Check if boundary layer separation occurs or not

B) Derive the Continuity equation in steady incompressible three dimensional flow   10

Q5 A) A 120° bend cum reducer has 300 mm diameter at inlet and 200 mm diameter at the   10
outer end. When it carries a flow 0.3 m³/s of water, the pressure at the inlet section
is 210 kN/m². Assuming no energy loss in the bend determine the force exerted by
the water on the bend. The bend is in a horizontal plane.

B) Crude oil of specific gravity 0.85 flow upwards at a volume rate of flow of 60 litre   10
per second through a vertical Venturimeter with an inlet diameter of 200 mm and a
throat diameter of 100 mm. The Cd is 0.98. The vertical distance between the
pressure tapping is 300 mm.
(i) If two pressure gauges are connected at the tappings such that they are positioned
at the levels of their corresponding tapping points, determine the difference of
reading in N/cm² of the two pressure gauges.

Q6 A) Two pipes of diameters 50 cm and 25 cm are each 350 m long. What will be the loss   10
of head when they are connected in series and carry a total discharge of 0.15 m³/s?
What will be the loss of head when same pipes are connected in parallel and carry
same total discharge? Take coefficient of friction is 0.0075 for both pipes. Neglect
minor losses.

B) **Solve any TWO**   10
(i) Explain various Major and Minor losses for flow through pipe?
(ii) Explain types of drag for flow around submerged objects.
(iii) Illustrate the difference between Buckingham π Theorem and Rayleigh's
Method in dimensional analysis.