Code No: R2021013 **R20** SET - 1

II B. Tech I Semester Supplementary Examinations, July - 2023
FLUID MECHANICS
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions, each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

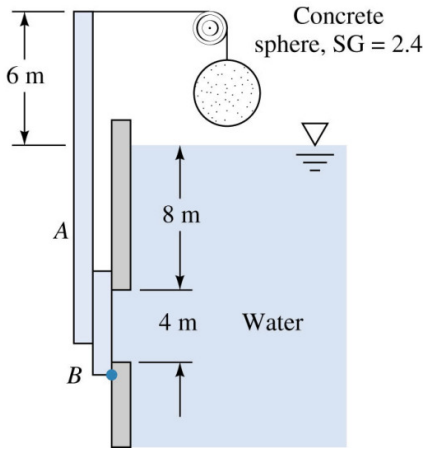
1 a) Derive an expression for the depth of center of pressure from free surface of liquid of an inclined plane surface submerged in the liquid. [7M]

b) If the surface tension at the soap-air interface is 0.088 N/m, calculate the pressure difference between the inside and outside of the soap bubble of 3 cm diameter. [7M]

Or

2 a) Two large fixed parallel planes are 240 mm apart. The space between the surfaces is filled with oil of viscosity 0.81 Ns/m^2. A flat thin plate of 0.5 m^2 area moves through the oil at a velocity of 0.6 m/s. Calculate the drag force
(i) When the plate is equidistant from both the planes
(ii) When the thin plate is at a distance of 80 mm from one of the plane surfaces. [7M]

b) Gate AB is 3m wide into the paper and is connected by a rod and pully to a concrete sphere (SG= 2.4) as shown in figure. What diameter of the sphere is just sufficient to keep the gate closed? [7M]



UNIT-II

3 a) Define steady, non- steady, uniform and non-uniform flows. [7M]

b) A 30 mm fire nozzle held at 1.5 m above ground discharging 10 lpshas to reach a window in a wall 15m away and 10m above ground. At what angle or angles of the inclination to the horizontal, the nozzle is to be held? Neglect the air resistance. [7M]

Or

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4 a) From the law of conservation of mass, show whether the flow field represented by $u= -3xy+y^2$ and $v=x^2+3y+y\log x$ is a possible velocity field for 2-dimensional incompressible fluid flow. [7M]

b) A 45° reducing bend is connected in pipeline, the diameters at the inlet and outlet of the bend being 400 mm and 200 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet of the bend is 215.8 kN/m^2. The rate of flow of water is 0.5 m^3/s. [7M]

UNIT-III

5 a) Derive a relationship between shear stress and pressure gradient. [7M]

b) In a pipe of 200 mm diameter, the maximum velocity of flow is found to be 1.5 m/s. If flow in the pipe is laminar, find the average velocity and radius at which it occurs, and the velocity at 40 mm from the wall of the pipe. [7M]

Or

6 a) Derive an expression for the loss of head due to friction in pipes? [7M]

b) A smooth pipe 100 mm in diameter and 1000 m long carries water at the rate of 0.0075 m^3/s. If the kinematic viscosity of water is 0.02 Stokes, calculate Head lost, Wall shearing stress and center-line velocity. [7M]

UNIT-IV

7 a) Derive an expression for discharge through fully submerged orifice. [7M]

b) The head of water over an orifice of diameter 100 mm is 10 m. The water coming out from orifice is collected in circular tank of diameter 1.5m. The rise of water level in the tank is 1.0 m in 25 seconds. Find the coefficient of discharge. [7M]

Or

8 a) Derive an expression for the discharge over a rectangular notch in terms of head of water over the crest of the notch. [7M]

b) Find the discharge through a trapezoidal notch which is 1.0 m wide at the top, 0.4 m at the bottom and 0.3 m in height. The head of water on the notch is 0.2 m. Assume C_d as 0.62 for the rectangular portion and 0.6 for the triangular portion. [7M]

UNIT-V

9 a) Define boundary layer and explain the fundamental causes of its existence. [7M]

b) For a steady Poiseuille flow I a pipe of radius R, obtain an expression for ratio of the displacement thickness to momentum thickness. [7M]

Or

10 a) What is the “slip condition” at the boundary? [7M]

b) Derive an expression for the lift produced on a rotating cylinder placed in a uniform flow field such that the axis of the cylinder is perpendicular to the direction of flow. [7M]