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

II B. Tech I Semester Regular Examinations, Feb/March - 2022
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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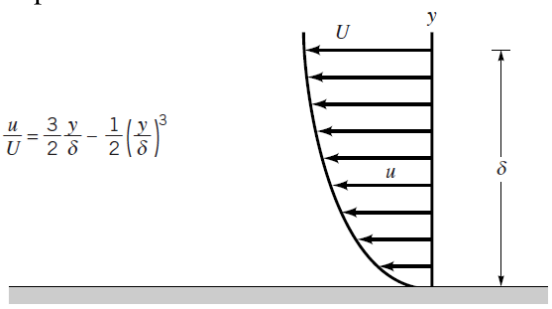
1 a) What is capillarity? Derive an expression for height of capillary rise.

b) A Newtonian fluid having a specific gravity of 0.92 and a kinematic viscosity of 4×10^{-4} m^2/s flows past a fixed surface. Due to the no-slip condition, the velocity at the fixed surface is zero, and the velocity profile near the surface is shown in Fig. Determine the magnitude and direction of the shearing stress developed on the plate.



Or

2 a) Derive expressions for total pressure and center of pressure for a vertically immersed surface.

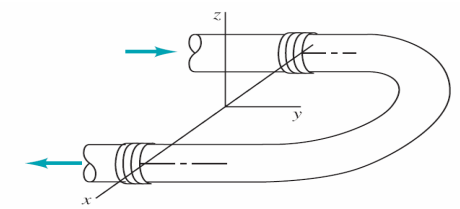
b) A cylinder of 0.122-m radius rotates concentrically inside a fixed cylinder of 0.128-m radius. Both cylinders are 0.305 m long. Determine the viscosity of the liquid that fills the space between the cylinders if a torque of 0.881 N • m is required to maintain an angular velocity of 60 revolutions per minute.

3 a) Derive continuity equation in Cartesian o-ordinates.

b) A nozzle is designed to accelerate the fluid from V_1 to V_2 in a linear fashion. That is V= ax + b, where a and b are constants. If the flow is constant with V_1= 10 m/s at x_1=0 and V_2= 25 m/s at x_2=1m, determine the local acceleration, the convective acceleration and the acceleration of the fluid at points (1) and (2).

Or

4 a) Water flows through a horizontal, 180° pipe bend as shown in Fig. The flow cross section area is constant at a value of 9000 mm^2.The flow velocity everywhere in the bend is 15 m/s. The pressures at the entrance and exit of the bend are 210 and 165 kPa, respectively. Calculate the horizontal(x and y) components of the anchoring force needed to hold the bend in place.



b) State and prove Bernoulli's equation

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5 a) Draw a neat sketch of the Reynolds apparatus and explain how the laminar flow can be demonstrated with the help of apparatus.

b) What power is required per km of a line to overcome the viscous resistance to the flow of glycerin through a horizontal pipe of diameter 100 mm @ 10 l/s? Take Dynamic viscosity as 8 poise and Kinematic viscosity as 6 stokes.

Or

6 a) Obtain an expression for the co-efficient of friction in terms of shear stress.

b) The velocity of flow in a badly corroded 8 cm pipe is found to increase 30% as a pitot tube is moved to a pint 1 cm from the wall to 3 cm from the wall. Estimate the height of the roughness elements.

7 a) Obtain an expression for time of emptying a circular horizontal tank.

b) A tank has 2 identical orifices in one of its vertical sides. The upper orifice is 2 m below water surface and the lower one is 4 m below the water surface. If the value of C_v for each orifice is 0.9, find the point of intersection of the 2 jets?

Or

8 a) How are notches and weirs are classified?

b) A right angled V-notch is used for measuring a discharge of 0.03 m^3/s. An error of 1.5 mm was made while measuring the head over the notch. Calculate the percentage error in the discharge. Assume C_d as 0.62 for the notch.

9 a) Obtain an expression for the boundary shear stress in terms of momentum thickness.

b) The velocity distribution in the boundary layer is given by $\frac{u}{U} = \left(\frac{y}{\delta}\right)^{1/7}$

Calculate the Displacement thickness, momentum thickness, shape factor and energy thickness.

Or

10 a) Obtain Von-karman momentum integral equation.

b) If the velocity distribution in laminar boundary layer over a flat plate is assumed to be given by a polynomial$u = a + by + cy^2$, determine its form using the necessary boundary conditions.