CBCS SCHEME

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15AU42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing full question from each module.***

Module-1

1 a. Define the following terms ands mention their SI units :
i) Weight density
ii) Specific gravity
iii) Viscosity
iv) Capillarity. **(08 Marks)**

b. Calculate the capillary rise in a glass tube of 2.5mm diameter when immersed vertically in i) water and ii) mercury. Take surface tensions $\sigma = 0.0725$ N/m for water and $\sigma = 0.52$N/m. for mercury in contact with air. The specific gravity for mercury is given as 13.6 and angle of contact = 130°. **(08 Marks)**

OR

2 a. Obtain the expression for total pressure and the centre of pressure on an inclined plane surface immersed in a fluid. **(08 Marks)**

b. Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4m and altitude 4m. When it is immersed vertically in an oil of specific gravity 0.9. The bore of the plate coincides with the free surface of oil. **(08 Marks)**

Module-2

3 a. Define the following terms :
i) Buoyancy ii) Centre of buoyancy iii) Meta centre iv) Meta centric height. **(08 Marks)**

b. A block of wood of specific gravity 0.7 floats in water. Determine the meta centric height of the block if its size is 2m × 1m × 0.8m. **(08 Marks)**

OR

4 a. Derive continuity equation for a three dimensional fluid flow in Cartesian co-ordinates. **(08 Marks)**

b. Velocity potential function of a two dimensional fluid flow is given by $\phi = x(2y - 1)$. Check the existence of flow. Determine the velocity of flow at a P(2, 3) and the stream function. **(08 Marks)**

Module-3

5 a. Derive an expression for Bernoulli's equation from the first principles and also mention the assumptions made. **(08 Marks)**

b. A pipe line carrying oil of specific gravity 0.8 changes in diameter from 300mm at position A to 500mm diameter at position B. Which is 5m at a higher level. If the pressure at A and B are 20N/cm^2 and 15N/cm^2 respectively and discharge is 150 liters/sec. Determine the loss of head and direction of flow. **(08 Marks)**

OR

6 a. What is a venturimeter? Derive an expression for discharge through a venturimeter. **(08 Marks)**

b. An orifice meter with orifice diameter 10 cm is incented in a pipe of 20cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter give readings of 19.62N/cm^2 and 9.81N/cm^2 respectively. C_d for the meter is 0.6. Find the discharge of water through the pipe. **(08 Marks)**

Module-4

7 a. What is dimensional analysis? State Buckingham π theorem and explain the procedure to determine π groups. **(08 Marks)**

b. The efficiency η of a fan depends on the density S, the dynamic Viscosity μ of the fluid, the angular velocity w, diameter D of the rotor and discharge Q. Express η in terms of dimensionless parameter. **(08 Marks)**

OR

8 a. Derive Darcy – Weisback equation for determining loss of head due to friction in pipe. **(08 Marks)**

b. Determine the rate of flow of water through a pipe of diameter 20cm and length 50m. When one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4m above the centre of the pipe consider all minor losses and take f = 0.009 in the formula $h_f = \frac{4_f LV^2}{2gd}$. **(08 Marks)**

Module-5

9 a. Derive Hagen – Poiseuille's equation for laminar flow through circular pipe. **(08 Marks)**

b. There is a horizontal of crack 40mm wide and 2.5mm deep in a wall of thickness 100mm. water leaks through the crack. Find the rate of leakage of water through the crack if the difference of pressure between the two ends of crack is 0.02943 N/cm^2. Take the viscosity of water equal to 0.01 poise. **(08 Marks)**

OR

10 a. Derive an expression for drag and lift. **(08 Marks)**

b. A projectile travels in air of pressure 15N/cm^2 at 10°C, at speed of 1500km/hr. Find the Mach number and Mach angle. Assume r = 1.4 and R = 287J/kgK. **(08 Marks)**

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