CBCS SCHEME

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18IM33

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Whether viscosity of fluids varies with temperature? If yes, give reason. **(04 Marks)**

b. Derive an expression for capillary rise. **(06 Marks)**

c. Distinguish between the following and mention their units :
i) Specific weight and mass density ii) Surface tension and capillarity
iii) Dynamic viscosity and kinematic viscosity iv) Ideal fluid and real fluid
v) Newtonian and non – Newtonian fluid. **(10 Marks)**

OR

2 a. Establish a relationship among absolute gauge and atmospheric pressure, with a simple sketch. **(10 Marks)**

b. The velocity distribution of flow over a plate is a parabolic with vertex 20cm from the plane, where the velocity is 120cm/s. If the viscosity of the fluid of 8.5 poise. Find the velocity gradient and shear stresses at a distance of 0, 10 and 20cm from the plane. **(10 Marks)**

Module-2

3 a. Obtain the total pressure and centre of pressure on vertical plane surface immersed in a fluid. **(10 Marks)**

b. Define the following : i) Buoyancy ii) Centre of Buoyancy
iii) Rotational fluid iv) Laminar flow v) Non – uniform flow. **(10 Marks)**

OR

4 a. Explain the importance of metacentric height to determine the stability of floating bodies. **(10 Marks)**

b. A wooden block of specific gravity 0.75 floats in water. If the size of the blocks is 1m × 0.5m × 0.4m. Find its metacentric height. **(10 Marks)**

Module-3

5 a. Derive the Euler's equation of motion for steady flow of an incompressible fluid and subsequently derive the Bernoulli's equation. **(10 Marks)**

b. A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of water. The pressure at the inlet is 17.658 N/cm^2 and vaccume pressure at the throat is 30cm of mercury. Find the discharge of water through the venturimeter. **(10 Marks)**

OR

6 a. Derive an expression for discharge through a rectangular notch. **(10 Marks)**

b. Differentiate between orifice meter and venturimeter. **(05 Marks)**

c. A pitot tube placed in a center of a 300mm pipeline has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.8 of the central velocity. Find the discharge through the pipe if the pressure difference between the two orifice is 60mm of water. Take the coefficient of pitot tube as $C_V = 0.98$. **(05 Marks)**

Module-4

7 a. Derive Darcy's equation for head loss due to friction in a circular pipe. **(10 Marks)**

b. Explain any five energy losses that occurs in pipes. **(10 Marks)**

OR

8 a. Derive Chezy's equation for loss of heat due to friction in pipe from Darcy's equation. **(08 Marks)**

b. Solve for head loss due to friction in a pipe of diameter 300mm and length 50m through which water is flowing at a velocity of 3m/s using i) Darcy's formula ii) Chezy's formula for which C = 60. Take kinematic viscosity (ν) of water as 0.01 stoke. **(12 Marks)**

Module-5

9 a. Explain the dimensional homogeneity, with an example. **(05 Marks)**

b. State the Buckingham's π Theorem. **(05 Marks)**

c. The resulting force F of supersonic plane during flight can be considered as dependent upon the length of the aircraft (ℓ) , velocity (v) , air viscosity (μ) , air density (e) and bulk modulus of air (k), Show that

$$F = \ell^2 ve\, f\left(\frac{\mu}{\ell ve}, \frac{k}{v^2 e}\right).$$ **(10 Marks)**

OR

10 a. What is geometric , kinematic and dynamic similarities? **(05 Marks)**

b. Define the following dimensionless numbers and mention their significance in fluid flow :
i) Reynold's number ii) Froude's number. **(05 Marks)**

c. Velocity of a fluid flow through a circular orifice , is dependent on head of flow (H) , orifice diameter (D) , absolute viscosity (μ) , mean density (e) and gravitational acceleration (g). By dimensional analysis using Buckingham's π theorem. Show that

$$V = \sqrt{2gH}\ \phi\left[\frac{D}{H}, \frac{\mu}{evH}\right]$$ **(10 Marks)**

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