CBCS SCHEME

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15MT42

Fourth Semester B.E. Degree Examination, June/July 2019
Fluid Mechanics and Machines

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. briefly explain the following :
i) Viscosity ii) Surface tension iii) Vapour pressure iv) Cavitation. **(08 Marks)**

b. Define and prove Pascal's Law. **(04 Marks)**

c. The right limb of a simple V-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.8 is flowing. The centre of pipe is 10cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 16cm. **(04 Marks)**

OR

2 a. Define total pressure and center of pressure on submerged plane surfaces. **(02 Marks)**

b. Derive relation for centre of pressure on a submerged surface at an angle 'θ' to the free surface of liquid. **(06 Marks)**

c. A circular opening 3m diameter in a vertical side of a tank is closed by a disc of 3m diameter which can rotate about a horizontal diameter.
Calculate :
i) the force on the disc
ii) the torque required to maintain the disc in equilibrium in the vertical position when the head of water above the centre of gravity of disc is 4m. **(08 Marks)**

Module-2

3 a. Derive a continuity equation for three dimensional flows in Cartesian coordinate. **(05 Marks)**

b. The velocity vector in a fluid flow is given : $V = 4x^3i - 10x^2yj + 2tk$. Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time t – 1 unit. **(06 Marks)**

c. A velocity potential for a two dimensional flow is given by $\phi = x^2 - y^2$ determine :
i) velocity components in x and y direction
ii) stream function, ψ. **(05 Marks)**

OR

4 a. Derive the Euler's equation of fluid motion and hence obtain the Bernaulli's equation. **(07 Marks)**

b. Mention the assumption made in deriving the Bernaulli's equation. **(02 Marks)**

c. A nozzle of diameter 18mm is fitted to a pipe of diameter 38mm. Find the force exerted by the water on the nozzle. The water flowing through nozzle emerges into air at the rate of $1m^3/min$. **(07 Marks)**

Module-3

5 a. Determine the dimensions of the quantities given below :
i) angular velocity ii) angular acceleration iii) discharge iv) kinematic viscosity v) force vi) specific weight. (06 Marks)

b. What is similitude? What are the types of similarities? (02 Marks)

c. The pressure difference ΔP in a pipe of diameter, D length ℓ, due to viscous flow depend on the velocity V. Viscosity μ, and density ρ. Using Buckingham's π-theorem, obtain an expression for ΔP. (08 Marks)

OR

6 a. Explain the working of a pitot tube. (04 Marks)

b. Derive the relation for discharge through V-notch (triangular notch). (08 Marks)

c. An orificemeter with orifice diameter 10cm is inserted in a pipe of 20cm diameter. The pressure gauge fitted upstream and downstream of the orificemeter gives reading of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Co-efficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe. (04 Marks)

Module-4

7 a. Define : i) Turbomachine ii) degree of reaction. (04 Marks)

b. Give comparison of turbomachines with positive displacement machines. (06 Marks)

c. With a neat diagram. Explain various parts of turbomachines. (06 Marks)

OR

8 a. Derive Euler turbine equation. (08 Marks)

b. Explain the effect of blade discharge angel on energy transfer and degree of reaction in general radial flow machines. (08 Marks)

Module-5

9 a. Classify hydraulic turbine with an example for each class. (08 Marks)

b. Derive an expression for maximum efficiency $\eta_{max} = \frac{1 + Cb\cos B_2}{2}$ of Pelton wheel (terms of their useful meaning in equation). (08 Marks)

OR

10 a. What is compounding? What are the needs for it? (06 Marks)

b. Derive maximum blade efficiency of Parson's turbine, $\eta_{b,max} = \frac{2\cos^2\alpha_1}{1+\cos^2\alpha_1}$. (10 Marks)

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