CBCS Scheme

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15MA44

Fourth Semester B.E. Degree Examination, June/July 2018
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. Define the following terms with their units :
i) Capillarity ii) Surface Tension iii) Mass density iv) kinematic viscosity. **(06 Marks)**

b. Derive the relation for pressure intensity and the surface tensile force, in case of soap bubble. **(04 Marks)**

c. Two large plane surfaces are 2.4cm apart. The space between the surfaces is filled with glycerin. What force is required to drag a very thin plate of surface area 0.5 square meter between the two large plane surfaces at a speed of 0.6m/s, if the thin plate is at a distance of 0.8cm from one the plane surfaces. Take dynamic viscosity of glycerin is 8.1×10^{-1} N s/m^2. **(06 Marks)**

OR

2 a. State and prove Pascal's law. **(08 Marks)**

b. A differential mercury manometer is used for measuring the pressure difference between two pipes A and B. Pipe A is 500mm above the pipe B and deflection in Hg manometer is 200mm. Pressure intensity in pipe A is greater than pipe B. Pipes carry oil of sp.gr. 0.9. Find the pressure difference between two pipes. Sp.gr. of mercury = 13.6. **(08 Marks)**

Module-2

3 a. Distinguish between : i) steady and unsteady flow ii) uniform and non uniform flow iii) compressible and incompressible flow. **(06 Marks)**

b. Define the terms velocity potential function and steam function. **(04 Marks)**

c. A fluid flow field is given by $V = x^2y\,i + y^2z\,j - (2xyz + yz^2)k$. Prove that it is a care of possible steady incompressible fluid flow. Calculate velocity at the point (2, 1, 3). **(06 Marks)**

OR

4 a. State the Bernoulli's equation with assumptions and limitations. **(06 Marks)**

b. Derive the Bernoulli's equation from Euler's equation. **(06 Marks)**

c. Water is flowing through a pipe having diameters 30cm and 20cm at the bottom and upperend respectively. The intensity of pressure at bottom and is 250 kN/m^2 and the pressure at the upper end is 100 kN/m^2. Determine the difference in datum head if the flow through pipe is 40 liters per second. **(04 Marks)**

Module-3

5 a. Derive an expression for discharge through rectangular notch. **(06 Marks)**

b. A venturimeter filled to a 25cm diameter pipe in which maximum flow of water is 7.2 m^3/min and the pressure head is 6m of water. find the diameter of the throat. Take $C_d = 0.98$. **(06 Marks)**

c. A Pitot tube is placed in the centre of a 30cm diameter pipe. The mean velocity is 0.8 times the central velocity. Find the discharge through the pipe if the pressure difference is 6cm of water. Take C_V of pitot tube = 0.98. **(04 Marks)**

OR

6 a. What is similitude? Explain types of similitudes. **(08 Marks)**

b. The resisting force(F) of a supersonic plane during flight can be considered as dependant up on the length of the air craft(L), velocity (V), air viscosity (μ), air density(e) and bulk modulus of air(k). Express the functional relationship between these variables and the resisting force. **(08 Marks)**

Module-4

7 a. Derive Darcy – Weisbach expression for friction head loss in a pipe flow. **(08 Marks)**

b. Find the diameter of a pipe of length 2000m, when the rate of flow of water through the pipe is 200 liters/s and the head lost due to friction is 4m. Take the value of C = 50 in Chezy's formulate. **(08 Marks)**

OR

8 a. Derive an expression for Hagen Poiseuille's formula. **(10 Marks)**

b. Determine : i) the pressure gradient ii) the shear stress at the two horizontal parallel plates iii) the discharge per meter width for the laminar flow of oil with a maximum velocity of 2m/s between two horizontal parallel fixed plates which are 100mm apart. Given $\mu = 2.44525$ N.s/m^2. **(06 Marks)**

Module-5

9 a. With neat sketch, explain the parts of a centrifugel pump. **(06 Marks)**

b. Define the following : i) cavitations ii) priming. **(06 Marks)**

c. The diameters of an impeller of a centrifugel pump at inlet and outlet are 30cm and 60cm respectively. Determine the minimum starting speed of the pump if it works against a heat of 30 meters. **(04 Marks)**

OR

10 a. Explain the following : i) slip ii) power in put factor iii) surging. **(06 Marks)**

b. An axial compressor having 8 stages compresses air in the pressure ratio of 4 : 1 and the degree of reaction is 0.5. Air enters the compressor at 20°C and flows with a constant velocity of 90 m/s and the blade speed is 180m/s. If the isentropic efficiency of the compressor is 0.82. Calculate : i) work done per kg ii) Blade angles. **(10 Marks)**

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