CBCS Scheme

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15AU42

Fourth Semester B.E. Degree Examination, June/July 2018
Fluid Mechanics

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 fluid properties : i) Specific weight ii) cavitation iii) capillarity iv) surface tension v) vacuum pressure. **(05 Marks)**

b. Two large plane surfaces are 2.8cm apart. The space between the surfaces is filled with fluid. What force is required to drag a very thin plate of surface area 0.5 square meter between the two plane large surfaces at a speed of 0.8m/s, if :
i) The thin plate is in the middle of the two plane surfaces
ii) The plate is at a distance of 1.0cm from one of the plane surface?
Take dynamic viscosity of fluid is 8.1 poise. **(08 Marks)**

c. Derive an expression for the capillary fall. **(03 Marks)**

OR

2 a. State and prove Pascal's law. **(05 Marks)**

b. Find out the differential reading 'h' of an inverted U-tube differential manometer containing oil of specific gravity 0.7 as the manometric fluid, when connected across pipe A and B as shown in Fig. Q2(b) below, conveying liquid of specific gravity 1.2 and 1.0 and a immicible with manometric fluid pipe A and B located at the same level. Assume pressure at A and B are equal. **(06 Marks)**

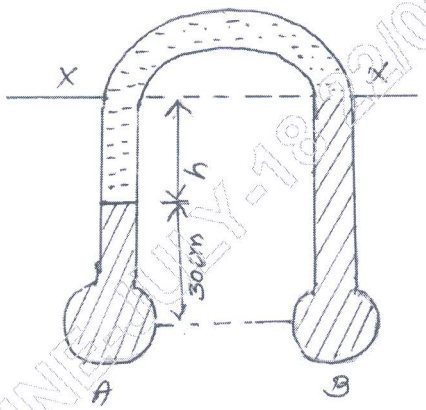

Fig.Q2(b)

c. Determine total pressure and centre of pressure on an isosceles triangular plate of base 4m and latitude 4m, when it is immersed vertically in an oil of specific gravity 0.9. The base of the plate coincides with the free surface of oil. **(05 Marks)**

Module-2

3 a. Explain the conditions of equilibrium for a floating body with neat sketches. **(04 Marks)**

b. Explain the method to find metacentric height experimentally. **(06 Marks)**

c. A solid cylinder of diameter 6.0m has a height of 8.0m. Find the metacentric heights of the cylinder, if the specific gravity of the cylinder is 0.6 and it is floating in water with its vertical axis. State whether the equilibrium is stable or unstable. **(06 Marks)**

OR

4 a. Define : i) Laminar flow ii) Turbulent flow iii) velocity potential function iv) stream function. **(04 Marks)**

b. Obtain an expression for continuity equation for a three dimensional flow. **(06 Marks)**

c. The stream function for a two-dimensional flow is given by $\Psi = 2xy$, calculate the velocity at the point P(2, 3). Find the velocity potential function. **(06 Marks)**

Module-3

5 a. Derive the Euler's equation of motion for a ideal fluid and hence deduce Bernoulli's equation of motion. **(08 Marks)**

b. The water is flowing through a pipe of length 100m having diameters 600mm at upper end and 300mm at lower end, at the rate of 50 litres/s. The pipe has a slope of 1 in 30.Find the pressure at lower end, if the pressure at the higher end is 19.62 N/cm^2. **(08 Marks)**

OR

6 a. Derive an expression for actual discharge through orifice meter. **(08 Marks)**

b. A 30cm × 15cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the difference in elevation of the throat section and entrance section of the venturimeter is 30cm. The flow is upwards. The differencial U-tube mercury manometer shows a gauge deflection of 25cm calculate :

i) The discharge of oil

ii) The pressure difference between the entrance section and the throat section. Take the co-efficient of discharge as 0.98 and specific gravity of mercury as 13.6. **(08 Marks)**

Module-4

7 a. The efficiency 'η' of a fan depends on density 'ρ' dynamic viscosity 'μ' of the fluid, angular velocity ω; diameter 'D' of the rotor and the discharge Q, express 'η' in terms of dimensionless parameters. **(08 Marks)**

b. Explain the following terms : i) Geometric similarity ii) kinematic similarity. **(04 Marks)**

c. Find the expression for the power P, developed by a pump, when P depends upon the head H; the discharge Q and specific weight 'ω' of the fluid. **(04 Marks)**

OR

8 a. Derive Darcy's formula to calculate the frictional head loss in a pipe. **(08 Marks)**

b. Find the loss of head when a pipe of diameter 200mm is suddenly enlarged to a diameter of 400mm. The rate of flow of water through the pipe is 250 litres/s. **(04 Marks)**

c. Write a note on : i) Hydraulic gradient line ii) Total energy line. **(04 Marks)**

Module-5

9 a. For the laminar flow through a circular pipe, prove that :

i) The shear stress variation across the pipe section is linear

ii) Velocity variation is parabolic. **(10 Marks)**

b. The fluid of viscosity 0.7 N s/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100mm, the maximum shear stress at the pipe wall is given as 196.2 N/m^2. Find: i) pressure gradient ii) Renolds number. **(06 Marks)**

OR

10 a. Define displacement thickness and derive an expression for displacement thickness. **(08 Marks)**

b. Differentiate between : i) stream line body and bluff body ii) Pressure drag and friction drag. **(04 Marks)**

c. A aeroplane is flying at an height of 15km, where the temperature is –50°C. The speed of the plane is corresponding to M = 2.0. Assuming K = 1.4 and R = 287 J/kgk; find the speed of plane. **(04 Marks)**