CBCS Scheme

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15MR46

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.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 fluid. Distinguish between liquid and gasses. **(05 Marks)**

b. Derive on expression for a capillary fall, when the glass tube is dipped in mercury. **(05 Marks)**

c. $10m^3$ of mercury Weighs 136×10^4N. Calculate its specific weight, mass density, specific volume and specific gravity. **(06 Marks)**

OR

2 a. Define the following fluid properties :
i) Density
ii) Weight density
iii) Specific volume
iv) Specific gravity
v) Surface tension
vi) Viscosity. **(06 Marks)**

b. A cylinder of 120mm diameter rotates concentrically inside a fixed cylinder of diameter 125mm. both the cylinder are 300mm long. Find the viscosity of the fluid that fills the space between the cylinders if a torque 0.90 Nm required maintains speed of 60rpm. **(10 Marks)**

Module-2

3 a. Derive an expression for the meta centric height of a floating body. **(10 Marks)**

b. A jet of water from a 25mm diameter nozzle is directed vertically upwards. Assuming that the jet remains circular and neglecting any loss of energy that will be the diameter at a point 4.5m above the nozzle if the velocity with which the Jet leaves the nozzle is 12 m /s. **(06 Marks)**

OR

4 a. Classify the different types of fluid flow. **(06 Marks)**

b. A wooden cylinder of specific gravity = 0.6 and circular in cross – section is required to float in oil (sp.gr = 0.90). Find L/D ratio for the cylinder to float with its longitudinal axis vertical in oil, where 'L' is the height of cylinder and 'D' is its diameter **(10 Marks)**

Module-3

5 a. What is a Venturimeter? Derive an expression for discharge through a venturimeter. **(10 Marks)**

b. The frictional torque 'T' of a disc of diameter 'D' rotating at a speed 'N' in a fluid of viscosity 'μ' and density 'ρ' in a turbulent flow is given by $T = D^5N^2\rho\phi\left[\frac{\mu}{D^2N\rho}\right]$. Prove this by method of dimensions. **(06 Marks)**

OR

6 a. Explain the methods of dimensional analysis. **(06 Marks)**

b. A 30cm × 15cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being up wards. The difference in elevation of the throat section and entrance section of the venturimeter is 30cm. The differential U-tube mercury monometer shown a gauge deflation 25cm. calculate :

i) The discharge of oil, and

ii) The pressure difference between entrance section and the throat section. Take the co-efficient of meter 0.98 and specific gravity of mercury as 13.6. **(10 Marks)**

Module-4

7 a. Explain the terms

i) Major energy loss

ii) Minor loss

iii) Hydraulic gradient line

iv) Total energy line. **(10 Marks)**

b. Find the diameter of a pipe of length 2000mm when the rate of flow of water through the pipe is 200 ℓ/s and the head lost due to friction is 4m take the value of C = 50 in Chezy's formula. **(06 Marks)**

OR

8 a. Derive on expression for laminar flow through circular pipe (Hagen Poiseuille equation]. **(12 Marks)**

b. A crude oil of Kinematic viscosity 0.4 stokes is flowing through a pipe of diameter 300mm at the rate of 300 liters per second. Find the head lost due to friction for a length of 50m of the pipe. **(04 Marks)**

Module-5

9 a. Derive on expression for drag and lift. **(08 Marks)**

b. Define :

i) Boundary layer

ii) Displacement thickness

iii) Momentum thickness

iv) Energy thickness. **(08 Marks)**

OR

10 a. Define mach number. With neat sketch, explain the propagation of disturbance for M < 1 and M = 1. **(08 Marks)**

b. A flat plate 1.5m × 1.5m moves 50km/hour in stationary air of density 1.15kg/m^3. If the co-efficient of drag and lift are 0.15 and 0.75 respectively. Determine :

i) The lift force

ii) The drag force

iii) The resultant force

iv) The power required to keep the plate in motion. **(08 Marks)**

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