CBCS Scheme

USN | | | | | | | | | | 15ME44

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 the following properties of fluid with their units :
i) Mass density ii) Dynamic viscosity iii) Surface tension **(06 Marks)**

b. Determine the specific gravity of a fluid having a kinematic viscosity of the 0.04 stoke and dynamic viscosity of 0.05 poise. **(04 Marks)**

c. An oil film of thickness 115mm is used for used for lubricating between a square plate of size 0.8m × 0.8m and an inclined plane having an exclinition of 30° with the horizontal. The weight of the square plate is 300N and slides down the plane with a uniform velocity of 0.3m/s. Find the dynamic viscosity of oil. **(06 Marks)**

OR

2 a. Define : i) Bouyancy ii) Meta centre. **(02 Marks)**

b. Derive an expression for total pressure force and depth of centre of pressure for a vertical surface submerged in water. **(08 Marks)**

c. A solid cylinder of diameter 4m has a height of 3m. Find the meta centre height when it is floating in water with its axis vertical. The Specific gravity of cylinder is 0.6. **(06 Marks)**

Module-2

3 a. Explain the two different fluid flow analysis method with suitable example. **(06 Marks)**

b. The velocity potential for 0 is given by $0 = -\frac{xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$

Calculate the velocity components in the X and Y direction. Check the possibility of such a flow. **(10 Marks)**

OR

4 a. Derive Euler's equation of motion for a steady flow and deduce Bernoullis equation. **(10 Marks)**

b. A horizontal venturimeter with inlet dia. 20cm and throat diameter 10cms is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and Vaccum pressure at the throat is 30cms of mercury. Find the discharge of water through venture meter $C_d = 0.9$. **(06 Marks)**

Module-3

5 a. Define Reynolds number. What is its significance? List the characteristic of laminar flow. **(08 Marks)**

b. A crude oil of viscosity 0.97 per sec and specific gravity 0.9 is flowing through a horizontal circular pipe of diameter of 0.1m and length 10m. Calculate the difference of pressure at two ends of the pipe if 100kg is collected in a tank in 0.5 minutes. Assume laminar flow. **(08 Marks)**

OR

6 a. Derive the Darcy Weisbach equation. **(08 Marks)**

b. A 10cm diameter pipe takes off abruptly from a large tank and run 5m, then expands to 20cm diameter abruptly and runs 50m and next discharge directly to open air with a velocity of 25m/s. Calculate the height of water surface above point of discharge. Take Darcy's coefficients 0.0065. **(08 Marks)**

Module-4

7 a. Define :
   i) Displacement thickness
   ii) Momentum thickness
   iii) Energy thickness
   iv) Shape factor as with respect to boundary layer. **(08 Marks)**

b. A man descends the ground from an airoplane with help of a parachute, which is hemispherical having a diameter of 5m against the resist of air with a uniform velocity of 25m/s. Find the weight of the man if the weight of parachute is 9.81, CD = 0.6. **(08 Marks)**

OR

8 a. Explain the different types of similitude. **(08 Marks)**

b. Assume the viscous force F exerted by a fluid on sphere of diameter D, depends on viscosity μ of mass density ρ and velocity of motion of the sphere, obtain the expression for shear force F, using Buckingham's π – theorem method. **(08 Marks)**

Module-5

9 a. Define: i) Mach line ii) Mach angle iii) Subsonic and supersonic flow. **(08 Marks)**

b. Calculate the velocity and Mach number of a supersonic aircraft flying at an altitude of 1200m when temperature is 300K. Sound of aircraft is heard 2 seconds after passage of aircraft over the head of an observer. Take r = 1.41, R = 287 J/kg/k. **(08 Marks)**

OR

10 a. Write short essay on the engineering application of CFD, brining the advantages and the limitations. **(08 Marks)**

b. Define the following terms and write the relevant equations for the same : -
   i) Stagnation Temperature
   ii) Stagnation Pressure. **(08 Marks)**

* * * * *