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ET-201(A)

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B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering) B.Tech. (Aero space Engineering)

Term-End Examination

June, 2012

ET-201(A) : MECHANICS OF FLUIDS

Time : 3 Hours *Maximum Marks : 70*

*Note : Attempt **any seven** questions. Suitably asssume any missing data. Be precise in your answer. Use of non-programmable calculators is **permitted**.*

1. (a) What do you understand by vapour pressure and what is its effect on the flow ? Explain with the help of a diagram. 5

   (b) A flat plate of 0.1 m^2 area moves at a velocity of 30 cm/s relative to another plate separated by a film of water 0.01 cm thick. Find the force and power required to maintain the velocity if the viscosity μ=0.001 N s/m^2 . 5

2. (a) What is a control volume ? Explain the concept of control volume and its applications to basic equations. 5

(b) Determine the total force and its location on the face of an annular disk (circular disk with a hole) with outer and inner diameters of 2 m and 1 m respectively located vertically 2m below the water surface . 5

3. (a) Differentiate between : 5

(i) Compressible fluid and incompressible fluid.

(ii) Absolute viscosity and Kinematic viscosity.

(iii) Lift and drag.

(iv) Orifice and nozzle.

(b) Examine whether the velocity field given by $u = 5x^3$, $v = -15x^2y$, $w = t$ represents a possible fluid motion of an incompressible fluid. 5

4. (a) Derive Euler's equation in streamline coordinates. How can we obtain Bernouli's equation from it ? State the assumptions made. 5

(b) Air flows through a horizontal nozzle steadily discharging to the atmosphere. If the inlet area of the nozzle is 0.2 m^2 and the area at the nozzle outlet is 0.04 m^2. Determine the gauze pressure required at the inlet to produce an outlet velocity of 50m/s. Take density of air at standard conditions as 1.23 kg/m^3 . 5

5. (a) Classify the flows as uniform one dimensional, two dimensional and three dimensional flows giving examples. 5

(b) A river flowing through a campus appears quite silent . We can estimate the average velocity to be about 0.2 m/s. The depth is only 0.6 m. Calculate the Reynolds number and determine whether the flow is laminar or turbulent. 5

6. (a) Distinguish between Eulerian and Lagrengian approach to fluid flow analysis. 4

(b) Two components of a velocity field are given below. Find the third component. $u=x^2+y^2+z^2$, $v=xy^2-yz^2+xy$ 6

7. (a) Explain the dimensional homogeneity in functions of variables. 4

(b) A new design of the front of a ship is to be tested in a water basin. A drag of 12.2 N is measured on the 1:20 scale model when towed at a speed of 3.6 m/s. Determine the corresponding speed of the prototype ship and expected drag. 6

8. (a) What is a notch ? Compare it with a wier. 4

(b) When water flows through a 90 deg. V-notch, show that the discharge is given by $KH^{5/2}$ where K is a constant and H is 6

the height of water above the bottom of the notch. Determine the value of K when H is measured in cm and Q in litres / s and the coefficient of discharge is 0.61.

9. (a) Differentiate between the following : 5
   (i) Displacement thickness and momentum thickness.
   (ii) Stream lines and Streak lines.
   (iii) Viscous and inviscid flow.
   (iv) Laminar and Turbulent flow.

   (b) Explain clearly the concept of viscocity in liquids and also in gases. 5

10. Explain with sketch and other details ***any one*** method of measuring . 10
   (a) Pressure
   (b) Velocity
   (c) Discharge
   (d) Viscosity