ET-201(A)

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

Term-End Examination

December, 2012

ET-201(A) : MECHANICS OF FLUIDS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Derive the expressions for the components of force for a jet striking a plane surface. Assume the jet to be in horizontal plane before and after the impact. 5

   (b) At a point in a horizontal pipeline the diameter is 24 cm, the velocity of water is 3.8m/s and the pressure is 3.6kg/sq.cm. At a point 18 cm down stream the diameter reduces to 14 cm. Calculate the pressure at the second point. 5

2. (a) Obtain the solution of Navier-Stokes equation for the case of Hagen-Poiseulle flow between parallel plates. 5

(b) A two dimensional channel converges from 2 m to 1 m linearly. An incompressible fluid flows through it at a constant rate of 10 m^3/s per unit width of the channel. Find the acceleration of the fluid as a function of distance between the two sections. 5

3. (a) Differentiate between : 5
   (i) Newtonian fluid and Non-Newtonian fluid.
   (ii) Absolute viscosity and Kinematic viscosity.
   (iii) Gases and liquids
   (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 Bernouli's equation starting from Euler's equation. 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 out let is 0.04 m^2. Determine the gauze pressure required at the inlet to produce an outlet velocity of 50 m/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. 5

(b) Two components of a velocity field are given below. Find the third component. 5

$u=x^2 + y^2 + z^2$, $v= xy^2 - yz^2 + xy$

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 the expected drag. 6

8. (a) What is a nozzle ? Compare it with an orifice. 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 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. **6**

9. (a) Differentiate between the following : **6**

(i) Hagen-Poiseulle flow and Couette flow.

(ii) Stream lines and path lines

(iii) Viscous and inviscid flow

(iv) Laminar and turbulent flow

(b) Explain clearly the concept of viscosity in liquid and also in gases. **4**

10. Discuss the application of Bernouli's equation with : **10**

(a) Pitot tube

(b) Venturimeter