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ET-201(A)

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

00203 **Term-End Examination**

December, 2016

ET-201(A) : MECHANICS OF FLUIDS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. Assume any missing data suitably. Use of non-programmable calculator is permitted.*

1. (a) What is Buoyant force ? Explain the stability of submerged and floating bodies. *5*

(b) What is a fluid ? Explain the different properties of a fluid. *5*

2. Write the expression for equation of continuity. A fluid flow field is given by

$$\vec{v} = x^2y\,\vec{i} + y^2z\,\vec{j} - (2xyz + yz^2)\,\vec{k}.$$

Prove that it is a case of possible steady incompressible flow. Calculate the velocity and acceleration at the point P(4, 2, 6). *2+8*

3. (a) What is π-theorem ? What is the significance of π-theorem ? *5*

(b) Explain the method of repeating variables. *5*

4. A jet of water emerges from a nozzle 1 cm in diameter at a velocity of 15 m/sec. The jet is found to break into a spray at a distance of 15 cm from the nozzle. The surface tension of the fluid is σ_1 = 50 dynes/cm. Another fluid with the mass density $\rho_2 = 0{\cdot}9\rho_1$, kinematic viscosity $\nu_2 = 1{\cdot}1\ \nu_1$ and surface tension = 75 dynes/cm issues from a geometrically similar nozzle. If the two nozzle flows are to be kinematically similar, determine the scale factors for length, velocity, force and time. *10*

5. (a) What is hydraulic jump ? Derive the relation for the same for a steady non-uniform flow. *5*

(b) Explain the losses for sudden enlargement in a pipe flow. Show that the loss due to sudden enlargement is given by

$$h_l = \left(\frac{v_1 - v_2}{2g}\right)^2$$

where $v_1 \rightarrow$ inlet velocity,

$v_2 \rightarrow$ outlet velocity. *5*

6. (a) Describe the working of a venturimeter and an orifice meter. *5*

(b) Show that viscous terms become zero for irrotational flow of incompressible fluids in Navier-Stokes equation of motion. *5*

7. Define any ***five*** of the following : *5×2*

(a) Turbulent Flow

(b) Instantaneous Velocity

(c) Isotropic Turbulence

(d) Wall Turbulence

(e) Free Turbulence

(f) Mixing Length

8. (a) Distinguish between the following : *5×1*

(i) Centre of pressure and Centre of buoyancy

(ii) Velocity potential and Stream function

(iii) Single point manometer and Differential manometer

(iv) Laminar flow and Turbulent flow

(v) Absolute pressure and Gauge pressure

(b) What is Reynolds Number ? Explain its significance. *5*

9. (a) Define deformation drag. Also differentiate between form drag and friction drag. *5*

(b) Derive the relation for drag on sphere. *5*

10. Explain any ***four*** of the following : $4 \times 2\frac{1}{2} = 10$

(a) Geometric Similarity

(b) Dynamic Similarity

(c) River Models

(d) Surge Tanks

(e) Water Hammer
