No. of Printed Pages : 4

ET-201(A)

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

Term-End Examination

00027

December, 2017

ET-201(A) : MECHANICS OF FLUIDS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. Suitably assume any missing data. Use of scientific calculator is permitted.*

1. (a) What are the conditions of equilibrium of a floating body and a submerged body ? Explain how to determine the metacentric height of a floating body. 5

(b) Derive the Bernoulli's equation from Euler's equation of motion. List the assumptions made in the derivation of Bernoulli's equation. 5

2. (a) Find the expression for discharge over a triangular notch with a vertex angle 2θ. 5

(b) Differentiate between the following : 5

(i) Laminar and Turbulent flow

(ii) Notch and Weir

3. (a) Explain the following terms : 5

(i) Boundary Layer Thickness

(ii) Displacement Thickness

(iii) Momentum Thickness

(iv) Energy Thickness

(b) Derive an expression for the total press on an inclined immersed plane surface, and locate the position of centre of pressure. 5

4. The velocity distribution for a two-dimensional incompressible flow is

$$u = \frac{-x}{x^2 + y^2}, \quad v = \frac{-y}{x^2 + y^2}.$$

Show that it satisfies the equation of continuity

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0. \qquad 10$$

5. A certain flow pattern has a velocity potential

$$\phi = \frac{x^3}{3} - x^2 - xy^2 + y^2.$$

Determine the stream function ψ. 10

6. (a) Two smooth pipes have exactly the same diameter of 50 cm and carry different liquids at the same rate of 55·6 *l*/sec. If Reynolds number of flow in the pipes is 1000 and 50000 respectively, what is the ratio of maximum velocity in the two pipes ? Compute the ratio of their pressure gradient if the pipes are horizontal. Assume the mass density of the two liquids are the same. *5*

(b) Field test on a 30 cm cast iron water main indicates that the value of roughness has increased to 1·5 mm after many years of service. If the water main now carries a flow of 225 *l*/sec, what increase in flow at the same power would result by replacing the line with the new cast iron pipe of the same diameter ? *5*

7. (a) Find the ratio of friction drag on the front $\frac{2}{3}^{rd}$ and the rear $\frac{1}{3}^{rd}$ of a flat plate kept in a stream at zero incidence. What will be the ratio for the front and rear halves under similar conditions. Assume the turbulent boundary layer over the whole plate. *5*

(b) For turbulent flow through a pipe, show that $\frac{U_{max}}{U} = 1{\cdot}326\sqrt{f} + 1$. *5*

8. Briefly describe the following (any ***two***) : $2 \times 5 = 10$

(a) Local and average friction coefficient

(b) Pascal's law and its significance

(c) Differential manometer

(d) Real and ideal fluids

9. (a) Draw the characteristic curve for the variation of C_D with Re for the flow passing over a sphere. Explain the salient points. 5

(b) What are the different methods of determining the coefficient of viscosity of a liquid ? Describe any one method in detail. 5

10. Write short notes on any ***four*** of the following : $4 \times 2\frac{1}{2} = 10$

(a) Continuity Equation

(b) Water Hammer

(c) Viscosity

(d) Reynolds Number

(e) Head Loss

(f) Drag Force
