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ET-201(A)

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

Term-End Examination

00615

June, 2017

ET-201(A) : MECHANICS OF FLUIDS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Define rotational and vortex flow. *5*

(b) Derive an expression for discharge for flow through an orifice. *5*

2. The velocity potential is given by $\phi = x^2 - y^2$. Does this represent a possible flow field ? If so, prove that the flow is irrotational. *10*

3. (a) Derive Bernoulli's equation. Also state the basic assumptions made. *5*

(b) Define laminar, turbulent and steady flow. *5*

4. (a) Explain similitudes and model studies. Also write the advantages of dimensional analysis. 5

(b) Show that for a cone bearing, the torque T required to rotate the shaft at a constant angular speed ω rad/s is

$$T = \pi \mu\omega \tan^3 \theta \, . \sec \theta/2d$$

where 2θ is the vertex angle of the cone and 'd' will be the gap between the cone and the bearing. 5

5. (a) Explain the following : 5

(i) Vena contracta

(ii) Orifice

(iii) Weir and Notch

(iv) Surface tension and Viscosity

(v) Velocity of approach

(b) Two discs of 20 cm diameter each are placed 1 mm apart and the gap is filled with an oil of viscosity 0·8 kg/m-sec. Determine the power required to rotate the upper disc at 600 rpm while holding the lower one stationary. 5

6. If $u = yz + t$, $v = xz - t$, $w = xy$, find the acceleration at a point (2, 1, 3) at time $t = 0{\cdot}5$ sec. 10

7. (a) Obtain the solution of the Navier-Stokes equation for the ease of Hagen-Poiseuille flow between parallel plates. 5

(b) Distinguish between the Eulerian and Lagrangian approach to fluid flow analysis. 5

8. (a) Differentiate between the following : 6

(i) Hagen-Poiseuille flow and Couette flow

(ii) Streamline and Pathline

(iii) Absolute viscosity and Kinematic viscosity

(b) Classify flows as uniform, one-dimensional, two-dimensional and three-dimensional flows, giving examples. 4

9. Describe the following : 5×2=10

(a) Local and average friction coefficient

(b) Buckingham theorem

10. Write short notes on the following : 5×2=10

(a) Pascal's Law and its Significance

(b) Reynolds Number and its Application
