Code: 13A01408 **R13**

B.Tech II Year II Semester (R13) Supplementary Examinations December 2016

MECHANICS OF FLUIDS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is compressibility? How it varies with respect to temperature?
(b) Define atmospheric pressure, gauge pressure and absolute pressure.
(c) Define circulation and vorticity.
(d) What is Bernoulli's equation? Explain the terms.
(e) Write about Reynolds experiment.
(f) What is pitot tube? How velocity is determined?
(g) Explain about the concept of Boundary layer.
(h) Write any two methods for controlling of boundary layer.
(i) What do you know about Magnus effect?
(j) Define drag force and lift force. Explain about different types of drag forces.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Write about phenomenon of surface tension and Explain about surface tension on liquid droplet.

(b) The space between two square flat parallel plates is filled with oil. Each side of the plate is 720 mm. The thickness of the oil film is 15 mm. The upper plate, which moves at 3 m/s requires a force of 120 N to maintain the speed. Determine: (i) The dynamic viscosity of oil. (ii) The kinematic viscosity of oil if the specific gravity of oil is 0.95.

OR

3 (a) Explain the following with neat sketch:
(i) Simple manometers.
(ii) U tube manometers.
(iii) Single column manometers.

(b) A liquid is compressed in the cylinder having the volume of 0.0012 m^3 at a pressure of 690 N/cm^2. What would be the new pressure in order to make its volume 0.0119 m^3? Assume bulk modulus of elasticity of the liquid 6.9 x 10^4 N/cm^2.

UNIT – II

4 (a) Define Velocity Potential and Stream Function and explain about equipotential lines.

(b) The velocity potential function for a two-dimensional flow is $\Phi = x(2y - 1)$. At a point P (4, 5) determine: (i) The velocity. (ii) The value of stream function.

OR

5 (a) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem from first principle and state the assumptions made for such a derivation.

(b) 250 litres/sec of water is flowing in a pipe having a diameter of 300 mm. If the pipe is bent by 135°, find the magnitude and direction of the resultant force on the bend. The pressure of the water flowing is 400 kN/m^2. Take specific gravity of water as 9.81 kN/m^3.

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UNIT – III

6 (a) Derive Darcy Weisbach equation, the equation for head loss in pipes due to friction.

(b) Two pipes each 300 m long are available for connecting to a reservoir from which a flow of 0.085 m^3/sec is required. If the diameters of the two pipes are 0.30 m and 0.15 m respectively, determine the ratio of the head lost when the pipes are connected in series to the head lost when they are connected in parallel. Neglect minor losses.

OR

7 (a) Derive the expression for discharge in an orifice meter

(b) A vertical venturi meter carries a liquid of specific gravity 0.8 and has inlet and throat diameters 150 mm and 75 mm respectively. The pressure connection at the throat is 150 mm above that the inlet. If the actual rate of flow is 40 liters/s and C_d = 0.96, Calculate the pressure difference between inlet and throat.

UNIT – IV

8 (a) Define Boundary layer and derive the expression for energy thickness.

(b) Find the displacement thickness and the momentum thickness for the velocity distribution in the boundary layer given by: $\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$.

OR

9 (a) Explain about separation of boundary layer.

(b) For the velocity profile given below, state whether the boundary layer has separated or on the verge of separation or will remain attached with the surface:

(i) $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$

(ii) $\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$

UNIT – V

10 (a) Derive an expression for drag force on a flat plate due to boundary layer that is Von Karman momentum integral equation.

(b) A flat plate 1.5 m x 1.5 m moves at a 50 km/hour in the stationary air of density 1.14 kg/m^3. If the coefficient of drag and lift are 0.15 and 0.73 respectively. Determine: (i) The lift force. (ii) The drag force (iii) The resultant force. (iv) The power required to keep the plate in motion.

OR

11 (a) Derive the expression for drag on a sphere.

(b) Explain about development of lift on an airfoil.

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