Reg. No. :

Question Paper Code : 40774

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Third Semester
Civil Engineering
CE 6303 – MECHANICS OF FLUIDS
(Common to Environmental Engineering)
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. A needle 35 mm long rests on water surface at 20°C. What force over and above the needle's weight is required to lift the needle from contact with the water surface? Take σ (for water with air) at 20°C is 0.0728 N/m.
2. What do you understand by Hydrostatic law?
3. Write the expression for the rotational component of a fluid element in x-y, y-z and z-x plane.
4. Define the term 'vena contract'.
5. Draw the shear stress and velocity distribution diagram for the viscous flow in a circular conduit.
6. Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 m/s. Take kinematic viscosity of water is 0.01 stoke.
7. Differentiate displacement thickness and energy thickness.
8. How the drag force is different from a lift force?
9. Deduce the expression for Froude number.
10. What is an undistorted model?

PART – B (5×13=65 Marks)

11. a) Define total pressure and centre of pressure and if a circular plate 2.5 m diameter is immersed in water with its greatest and least depth below the free surface being 3 m and 1 m respectively. Find (a) the total pressure on one face of the plate and (b) the position of the centre of pressure.

(OR)

b) For a compound manometer shown in figure Q. 11 b, what is the gauge pressure at C if the manometric fluid is mercury and if the fluid in the pipe and in the tubing which connects the two U tubes is water ?

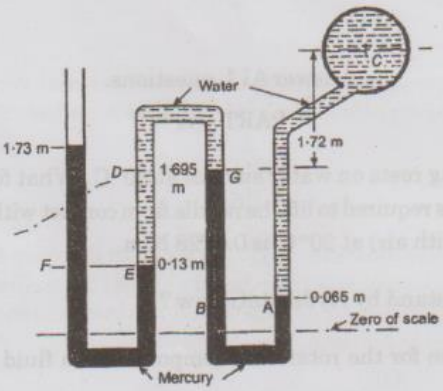

Fig. Q. 11 b

12. a) In a two dimensional incompressible flow, the fluid velocity components are given by u = x – 4y and v = – y – 4x. Show that the velocity potential function exists and determine its form. Find also the stream function.

(OR)

b) Explain the principle of a venturimeter with a neat sketch. Derive the expression for the rate of flow of fluid through it.

13. a) Show that the difference of pressure head for a given length of the two parallel plates which are fixed and through which viscous fluid is flowing is given by hf = (12 μ u L)/(ρ g t^2).

(OR)

b) Derive an expression for the loss of head due to sudden enlargement and sudden contraction of a pipe.

14. a) For the velocity profile for laminar boundary layer $u/U = (3/2)(y/\delta) - (1/2)(y/\delta)^3$. Determine the boundary layer thickness and shear stress in terms of Reynolds number.

(OR)

b) Discuss the concept of boundary layer formation, derive the expression for displacement thickness and list the methods of boundary layer separation.

15. a) The efficiency η of geometrically similar fans depends upon the mass density of air ρ, its viscosity μ, speed of the fan N (revolutions per second), diameter of blades D and discharge Q. Perform dimensional analysis using Buckingham's theorem.

(OR)

b) Discuss the types of non-dimensional numbers and derive any two of them. Also explain the significances of these dimensionless numbers for fluid flow problem.

PART – C **(1×15=15 Marks)**

16. a) A pipe line of 0.6 m diameter is 1.5 km long. To increase the discharge another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if $4f = 0.04$. The head at inlet is 300 mm.

(OR)

b) The difference in water surface levels in the two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and of diameters 300 mm, 200 mm and 400 mm respectively, is 12 m. Determine the rate of flow of water if co-efficient of friction is 0.005, 0.0052 and 0.0048 respectively, considering (i) minor losses also (ii) Neglecting minor losses.

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