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Q 2110

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Third Semester

Civil Engineering

CE 233 -- FLUID MECHANICS

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A -- (10 × 2 = 20 marks)

1. State Newton's law of viscosity.
2. Define Pascal's law of intensity of pressure.
3. Differentiate simple and differential manometer.
4. Define velocity potential function.
5. What do you mean by 'vena contracta'?
6. What is the use of Moody's diagram?
7. List down the minor losses in a pipe.
8. Explain the term 'boundary layer'.
9. Write the significance of Reynold's number.
10. Explain the term 'dimensionally homogeneous equation'.

PART B — (5 × 16 = 80 marks)

11. (a) The velocity profile of a viscous fluid over a plate is parabolic with vertex 20 cm from the plate, where the velocity is 120 cm/s. Calculate the velocity gradient and shear stress at a distance of 0, 5 and 15 cm from the plate, given the viscosity of fluid = 6 poise.

Or

- (b) (i) An open tank contains water upto a depth of 1.5 m and above it an oil of specific gravity 0.8 for a depth of 2 m. Find pressure intensity :
- (1) at the interface of the two liquids and
- (2) at the bottom of the tank. (6)
- (ii) Derive an expression for the meta-centric height of a floating body. (10)
12. (a) (i) What is a manometer? How they are classified? (6)
- (ii) A simple manometer is used to measure the pressure of oil (sp. gr. = 0.8) flowing in a pipe line. Its right limb is open to the atmosphere and left limb is connected to the pipe. The centre of the pipe is 9 cm below the level of mercury (sp. gr. 13.6) in the right limb. If the difference of mercury level in the two limbs is 15 cm, determine the absolute pressure of the oil in the pipe in N/cm². (10)

Or

- (b) (i) What are the different types of fluid flow, explain with example. (8)
- (ii) The velocity potential function (ϕ) is given by an expression
- $$\phi = \frac{-xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2.$$
- (1) Find the velocity components in x and y direction.
- (2) Show that ϕ represents a possible case of flow. (8)

13. (a) (i) Name the different forces present in a fluid flow. What are the forces taken into account for Euler's equation for motion? (6)
- (ii) Derive the Bernoulli's equation of motion from fundamental, stating clearly the assumptions made. (10)

Or

- (b) Derive an expression for Hagen-Poiseuille equation.
14. (a) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by
- $$\frac{u}{U} = 2 \left(\frac{Y}{\delta} \right) - \left(\frac{Y}{\delta} \right)^2.$$

Or

- (b) A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow.

Take $f = 0.01$ for both sections of the pipe.

15. (a) What are the methods of dimensional analysis? Describe Buckingham π theorem.

Or

- (b) (i) Explain the different types of hydraulic similarities that must exist between a prototype and its model. (10)
- (ii) Write a short notes on :
- (1) Pipes in parallel
- (2) Pipes in series. (6)