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C 3134

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Third Semester

(Regulation 2004)

Civil Engineering

CE 1202 — MECHANICS OF FLUIDS

(Common to B.E. (Part-Time) – Second Semester – Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

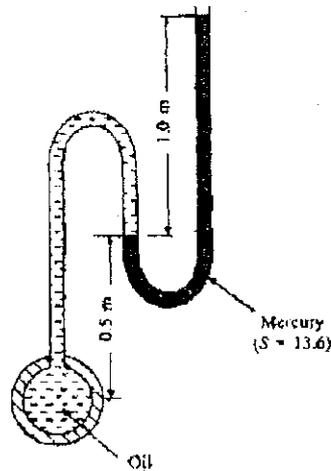
1. Define the following fluid properties. State their dimensions and units: Specific weight and specific gravity.
2. State and explain Newton's law of viscosity.
3. What will be the absolute pressure at a point 20 m below free surface of sea water? Assume specific weight of sea water as 1.05 kN/m³.
4. State the properties of velocity potential function.
5. State Bernoulli's theorem.
6. Explain Moody diagram.
7. Define displacement thickness.
8. What are secondary losses and their values?
9. State Buckingham Pie-theorem.
10. What is meant by similitude?

PART B — (5 × 16 = 80 marks)

11. (a) A piece of pipe with an internal diameter of 60.5 mm is slipped over a vertical smooth solid shaft of 60mm diameter. The weight of pipe is 50 N and the length is 0.6 m. A thin oil film of dynamic viscosity 200 poises is maintained between the shaft and the falling pipe. Find the uniform velocity with which the pipe would slip down the shaft.

Or

- (b) (i) A soap bubble 50 mm diameter has an internal pressure in excess of the outside pressure of 25 N/m^2 . Calculate tension in the soap film.
- (ii) Determine the minimum size of glass tubing that can be used to measure water level, if the capability rise in the tube is not to exceed 0.25 mm. Take surface tension of water in contact with air as 0.0735 N/m .
12. (a) (i) A U-tube containing mercury is used to measure the pressure of an oil of specific gravity 0.8 as shown in Figure. Calculate the pressure of the oil.



- (ii) An isosceles triangular plate of base 5 m and altitude 5 m is immersed vertically in an oil of specific gravity 0.8. The base of the plate is 2 m below the free water surface. Determine :

The total pressure, and

The centre of pressure.

Or

- (b) (i) A two-dimensional flow is described by the velocity components :

$$u = 5x^3 \text{ and } v = -15x^2y$$

Determine the stream function and velocity at $P(x = 1 \text{ m}, y = 2 \text{ m})$.

- (ii) In a 100 mm diameter horizontal pipe a venturimeter of 0.5 contraction ratio has been fixed. The head of water when there is no flow is 13.0 m absolute. Find the rate of flow for which the throat pressure will be 2 metres of water absolute. The coefficient of meter is 0.97. Take atmospheric pressure head = 10.3 m of water.

13. (a) The water is flowing through a pipe having diameters 200 mm and 100 mm at sections 1 and 2 respectively. The rate of flow through the pipe is 35 litres/s. The section 1 is 2 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 400 kN/m², find the intensity of pressure at section 2.

Or

- (b) A pipe 200 mm in diameter and 10000 m long is laid up at a slope of 1 in 200. An oil of specific gravity 0.9 and viscosity 0.15 Ns/m² is pumped up at the rate of 0.02 m³/s. Find :

- (i) Head lost due to friction, and
(ii) Power required to pump the oil,

14. (a) (i) Describe the growth of boundary layer on a flat plate held parallel to flow.
(ii) Water is flowing through a pipe of diameter 200 mm with a velocity of 3 m/s. Find the head lost due to friction for a length of 5 m if the coefficient of friction is given by $f = .02 + \frac{.09}{R_c^{0.3}}$, where R_c is Reynold number. The kinematic viscosity of water = .01 stoke.

Or

- (b) Two reservoirs are connected by two pipes of the same length laid in parallel. The diameter of the pipes are 100 mm and 300 mm respectively. If the discharge through 100 mm diameter pipe is 0.01 m³/s, what will be the discharge through 300 mm pipe? Assume that f is the same for both pipes.

15. (a) The pressure difference Δp in a pipe of diameter D and length L due to viscous flow depends on the velocity V , viscosity μ and density ρ . Using Buckingham's theorem, obtain an expression for Δp

Or

- (b) (i) Explain Reynold's law of similitude and Froude's law of similitude.
(ii) In 1:30 model of a spillway, the velocity and discharge are 1.5 m/s and 2.0 m³/s. Find the corresponding velocity and discharge in the prototype.
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