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Question Paper Code : 97027

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Third Semester

Civil Engineering

CE 6303 — MECHANICS OF FLUIDS

(Common to Environmental Engineering)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define specific volume of a fluid and write its unit.
2. Name the devices that are used to measure the pressure of a fluid.
3. Define circulation and write its expression.
4. Write Euler's equation.
5. Sketch the shear stress and velocity distribution for laminar flow across a pipe section.
6. List the major and minor losses encountered in pipe flow.
7. What are the different methods of preventing the separation of boundary layers?
8. Define the terms: Drag and Lift.
9. Define Froude's number and write its expression.
10. What are the merits of distorted models?

PART B — (5 × 16 = 80 marks)

11. (a) A liquid has a specific gravity of 0.72. Find its density, specific weight and also the weight per litre of the liquid. If the above liquid is used for lubrication between a shaft and a sleeve, find the power lost in liquid for a sleeve length of 100 mm. The diameter of the shaft is 0.5 m and the thickness of the liquid film is 1 mm. Take the viscosity of fluid as 0.5 N-s/m^2 and the speed of the shaft as 200 rpm.

Or

(b) A circular plate 1.2 m diameter is placed vertically in water so that the centre of plate is 2m below the free surface. Determine the total pressure and the depth of centre of pressure. The above circular plate is taken out of water and made in to a solid cylindrical body which weighs 4.5 N in water and 6 N in oil of specific gravity 0.8. Find the volume and weight of the body. Find also the density and specific gravity of the material of the body.

12. (a) If for a two-dimensional potential flow, the velocity potential function is given by $\phi = x(2y-1)$, determine the velocity at the point P(4, 5). Determine also the value of stream function ψ at the point P.

Or

(b) A venturimeter of inlet diameter 300 mm and throat diameter 150 mm is inserted in vertical pipe carrying water flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 200 mm. Find the discharge if the co-efficient of discharge of meter is 0.98.

13. (a) An oil of viscosity 1 N-s/m^2 flows between two parallel fixed plates which are kept at a distance of 50 mm apart. Find the discharge of oil between the plates. If the drop of pressure in a length of 1.2m be 3 kN/m^2. The width of the plate is 200 mm.

Or

(b) A horizontal pipeline 40m 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 discharge. Take the Darcy's co-efficient of friction as 0.01 for both sections of the pipe.

14. (a) A flat plate 1.5 m × 1.5 m moves at 50km/hour in stationary air of density 1.15 kg/m^3. If the co-efficient of drag and lift are 0.15 and 0.75 respectively, determine the lift force, drag force, resultant force and the power required to keep the plate in motion.

Or

(b) Find the displacement thickness and the momentum thickness for the velocity distribution in the boundary layer given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate and $u = U$ at $y = \delta$ where δ is the boundary layer thickness.

15. (a) The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. Use Buckingham's Π theorem.

Or

(b) Discuss briefly the types of forces acting in moving fluid and the importance of three types of similarity.

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