Reg. No. : | | | | | | | | | | | |

Question Paper Code : 27094

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

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. Write the expression for capillary fall in terms of surface tension for mercury.

2. What is meant by centre of pressure?

3. Distinguish between uniform and non-uniform flows.

4. Write the expression for the resultant force acting between two sections of the pipe in terms of discharge using impulse-momentum principle.

5. Sketch the typical hydraulic gradient and total energy gradients, when one end of the horizontal pipe is connected to the reservoir and the other end is open to the atmosphere.

6. Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The discharge of water through the pipe is 250 litres/sec.

7. Mention any two methods of preventing the separation of boundary layer.

8. Sketch the stationary body held in real fluid flowing at uniform velocity and indicate the components of the force exerted by the flowing fluid on the stationary body.

9. Show that the equation $v = \sqrt{2gh}$ is dimensionally homogeneous.

10. What are the advantages of distorted models?

PART B — (5 × 16 = 80 marks)

11. (a) A Plate 0.05 mm distance from a fixed plate, moves at 600 mm/s and requires a force of 3 N per unit area to maintain this speed. Determine the fluid viscosity between the plates. Also find the specific gravity and specific weight of the above fluid, if the kinematic viscosity of the fluid is $0.003 \times 10^{-4} m^2 / s$.

Or

(b) Find the density of a metallic body which floats at the interface of mercury of specific gravity 13.6 and water such that 40 percentage of its volume is submerged in mercury and 60 percentage in water.

12. (a) The stream function for a two-dimensional flow is given by $\psi = 2xy$. Calculate the resultant velocity at P(3,4). Also find the velocity potential function ϕ.

Or

(b) A horizontal venturi meter with inlet diameter 250 mm and throat diameter 120 mm is used to measure the flow of oil of specific gravity 0.85. The discharge of oil through the venturi meter is 80 litres/s. Find the reading of oil-mercury differential manometer. Take $C_d = 0.97$.

13. (a) Determine the pressure gradient, the shear stress at the two horizontal plates and the discharge per width for the laminar flow of oil with a maximum velocity of 3 m/s between two horizontal parallel fixed plates which are 120 mm apart. Given the dynamic viscosity of oil $= 2.5 N - s / m^2$.

Or

(b) A pipe of diameter 0.4 m and of length 2 km is connected to a reservoir at one end. The other end of the pipe is connected to a junction from which two pipes of lengths 1 km and diameter 0.3m run in parallel. These parallel pipes are connected to another reservoir, which is having a level of water 10m below the water level of the above reservoir. Determine the total discharge if Darcy's co-efficient of friction is 0.015. Neglect minor losses.

14. (a) Find the displacement thickness, the momentum thickness and energy 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 = boundary layer thickness.

Or

(b) A thin plate is moving in still atmospheric air at a velocity of 7 m/s. The length of the plate is 0.7 m and width 0.6m. Calculate the thickness of the boundary layer at the end of the plate and the drag force on one side of the plate. Take the density of air as 1.25 kg/m^3 and kinematic viscosity as $0.15 \times 10^{-4} m^2/s$.

15. (a) A partially submerged body is towed in water. The resistance R to its motion depends on the density ρ, the viscosity μ of water, length l of the body, velocity v of the body and acceleration due to gravity g. Using Buckingham's π method of dimensional analysis, express R in terms of dimensionless parameters.

Or

(b) Show that the time period of a pendulum $t = 2\pi\sqrt{L/g}$ using Rayleigh's method of dimensional analysis and brief the three types of similitude between model and its prototype.
