

M 2024

R.E/B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Third Semester

Civil Engineering

CE 1202 — MECHANICS OF FLUIDS

(Common to BE (PT) Second Semester Regulation 2005 Civil)

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A --- (10 × 2 = 20 marks)

1. State the definition of fluid.
2. Distinguish between specific mass and specific gravity.
3. Highlight the limitations of peizometers in pressure measurement.
4. State the differences of stream function and potential function.
5. Sketch the velocity distribution diagram for laminar flow occurring through a circular pipeline.
6. Describe the use of Moody's diagram.
7. Briefly explain the energy thickness.
8. Loss due to sudden contraction of pipes is classified as major loss or minor loss. Give its relation.
9. Narrate the applications of dimensional analysis.
10. What are distorted models? Quote an example.

11. (i) Considering two parallel plates show how the Newton's law of viscosity could be obtained. (9)
- (ii) A piston 500 mm in diameter and 150 mm long slides vertically down a cylinder of 600 mm inside diameter. If the clearance is filled with a lubricant oil of viscosity of 0.005 Ns/m^2 find the terminal speed of the piston. The weight of the piston is 6.40 N. (7)

12. (a) (i) Give the definitions of metacentre and metacentric height. (6)
- (ii) A solid wood cylinder with a diameter of 0.666 m and a height of 1.3 m. The specific gravity of the wood is 0.61. Would the cylinder be stable if placed vertically in oil of specific gravity 0.85? (10)

Or

- (b) (i) Distinguish between stream line and path line. (6)
- (ii) The velocity components in a two dimensional incompressible fluid flow are given as, $v = y^3 + 6x - 3x^2y$ and $v = 3yx^2 - 6y - x^3$.
- (1) Is the flow continuous?
- (2) Is the flow irrotational?
- (3) In case the flow is irrotational find the potential function and the stream function. (10)

13. (a) Derive the Euler's equation of motion and finally derive the Bernoulli's equation and clearly state its assumptions. (16)

Or

- (b) Derive the Hagen poiseuille's equation to show the head loss for a laminar flow. (16)
14. (a) (i) Explain how a boundary layer occurs in fluid flow. (7)
- (ii) Derive an expression for momentum thickness. (9)

Or

(b) (i) A 140.7 m long, 25.7 cm diameter concrete pipe and a 370.3 m long 30.48 cm diameter concrete pipe are connected in series. Calculate the length of an equivalent pipe of 25.4 cm diameter. (8)

(ii) Three pipelines $l_1 = 1800$ m, $D_1 = 1.25$ m, $f_1 = 0.006$, $l_2 = 1500$ m, $D_2 = 1$ m, $f_2 = 0.006$ and $l_3 = 1900$ m, $D_3 = 1.4$ m, $f_3 = 0.008$ are connected in parallel conveying a total discharge of 4.5 m³/s. Find the discharges in each of the pipes. (3)

15. (a) (i) Explain the procedures for selecting the repeating variables. (5)

(ii) The variables controlling the motion of a floating vessel through water are the drag force F , the speed V , the length L , the density ρ , dynamic viscosity μ of water and acceleration due to gravity g . Derive an expression for F by Buckingham Pi theorem. (11)

Or

(b) (i) A fluid of density ρ and viscosity μ flows through a pipe of diameter d . Show by Rayleigh's method the resistance per unit area of surface is given by, $F = \rho V^2 \phi(R_e)$, where V is the mean velocity of flow and R_e is the Reynold's number. (11)

(ii) State the different types of similitude. What is meant by scale ratio? (5)