

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2001

Third Semester

Electrical and Electronics Engineering

CE 261 — FLUID MECHANICS

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between ideal fluid and Newtonian fluid with mathematical expressions.
2. Define the capillary rise for, pure water and clean glass.
3. Define the term centistoke.
4. What is the difference between path line and streak line.
5. What is known as Darcy coefficient of friction?
6. What are the loss of head at the entrance to pipe and at the exit of a pipe?
7. What is the advantage of orificemeter over venturimeter?
8. Classify the turbines according to the head and quantity of water available.
9. Define the term specific speed.
10. What do you mean by pumps in series and parallel?

PART B — (5 × 16 = 80 marks)

11. (i) Define the surface tension and express the pressure inside (1) water droplet (2) soap bubble and (3) liquid jet. (6)
- (ii) A vertical cylinder of diameter 180 mm rotates concentrically inside another cylinder of diameter 181.2 mm. Both the cylinders are 300 mm high. The space between the cylinders is filled with a liquid. Determine the viscosity of the fluid, if a torque of 20 Nm is required to rotate the inner cylinder at 120 rpm. (10)

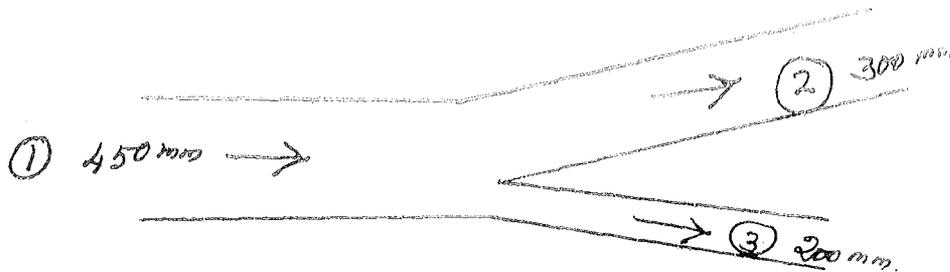
12. (a) In a two dimensional incompressible flow, the fluid velocity components are given by  $u = x - 4y$  and  $v = -y - 4x$ . Show that velocity potential exists and determine its form as well as stream function.

Or

- (b) Derive Euler's equation for Motion and prove Bernoulli's equation.

13. (a) (i) List out the types of fluid flows. (6)

- (ii) A main pipe ① of 450 mm diameter branches into two pipes ② and ③ of diameters 300 mm and 200 mm respectively as shown in figure. If the average velocity in 450 mm diameter pipe is 3 m/s find (1) discharge through 450 mm diameter pipe (2) velocity in 200 mm diameter pipe if the average velocity in 300 mm diameter pipe is 2.5 m/s. (10)



Or

- (b) Two reservoirs are connected by a pipeline consisting of two pipes, one of 15 cm diameter and length 6 m and the other of diameter 22.5 cm and 16 m length. If the difference of water levels in the two reservoirs is 6 m, calculate the discharge and draw the energy gradient line. Take  $f = 0.04$ .

14. (a) A vertical venturimeter carries a liquid of relative density 0.8 and has inlet and throat diameters of 150 mm and 75 mm respectively. The pressure connection at the throat is 150 mm above that at the inlet. If the actual rate of flow is 40 litres/sec. and  $C_d = 0.96$ , calculate the pressure difference between inlet and throat in  $N/m^2$ .

Or

- (b) A differential manometer connected at the two points A and B in a pipe containing an oil of specific gravity of 0.9, shows a difference in mercury levels as 150 mm. Find the difference in pressures at the two points.

15. (a) An inward flow reaction turbine operating under 30 m head, develops 4000 kW while running at 300 rpm. The overall efficiency of the turbine is 0.85; the hydraulic efficiency is 0.9; and the radial velocity of flow at inlet is 7 m/s; the inlet guide vane angle at full gate opening is  $30^\circ$ . Calculate the diameter and width of the runner at inlet. Blade thickness coefficient is 5%.

Or

- (b) A three throw reciprocating pump has cylinders of 250 mm diameter and stroke of 500 mm each. The pump is required to deliver  $0.1 \text{ m}^3/\text{s}$  at a head of 100 m. Friction losses are estimated to be 1 m in suction pipe and 19 m in delivery pipe. Velocity of water in delivery pipe is 1 m/s, Overall efficiency is 85% and the slip is 3%. Determine :
- (i) Speed of the pump and
  - (ii) Power required to run the pump.