# K 1133

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Third Semester

Electrical and Electronics Engineering

CE 261 — FLUID MECHANICS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define the term capillarity.

2. What is Newtonian fluid?

3. Distinguish between stream line and path line.

4. List out the assumptions of Bernoulli's equation.

5. Define the term equivalent pipe.

6. What are the advantages of manometers?

7. Distinguish between energy Gradient Line and Hydraulic Gradient Line.

8. Define the specific speed of a turbine.

9. Which is called as cavitation?

10. Define the term net positive suction head.

PART B — ($5 \times 16 = 80$ marks)

11. (i) 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 r.p.m. (10)

(ii) Determine the minimum size of glass tube that can be used to measure water level, if the capillary rise in the tube is not to exceed 0.3 mm. Take surface tension of water in contact with air as 0.0735 N/m. (6)

12. (a) (i) A pipe line carries oil, of specific gravity 0.83, at a velocity of 2 m/s through a 20 cm pipe. At another section, the diameter is 15 cm. Find the velocity at this section and the mass rate of flow. (6)

(ii) If $\phi = 3xy$ find $x$ and $y$ components of velocity at (1, 3) and (3, 3). Determine the discharge passing between stream lines passing through these points. (10)

Or

(b) (i) Water is pumped at the rate of 300 lit/sec. through a 30 cm pipe upto a hill top. On the hill top which has an elevation of 50 m, the diameter of pipeline reduces to 20 cm. If the pump maintains a pressure of 981 bar at the hill top, what is the pressure at the foot hills having zero elevation? What is the power required to pump the water? (8)

(ii) Water is to be supplied to a hostel of 4000 students, through a supply main. Water consumption per student per day is 180 litres. Length of supply main from reservoir is 3000 m; Loss of head due to friction is 18 m. Coefficient of friction for the pipe is 0.007. If half of the daily supply is pumped in 8 hours, Determine the size of the supply main. (8)

13. (a) (i) Derive the Darcy–Weisbach equation. (10)

(ii) A horizontal pipe carries water at the rate of 40 lit/sec. Its diameter, which is 0.3 m reduces abruptly to 0.15 m. Calculate the pressure change across the contraction if the coefficient of contraction is 0.62 and head loss due to contraction is 0.0978. (6)

Or

(b) (i) What is Dupit's equation? Where it is used? (4)

(ii) A piping system consists of three pipes arranged in series; the lengths of the pipes are 1200 m, 750 m, and 600 m and diameters 750 mm, 600 mm and 450 mm respectively.

(1) transform the system to an equivalent 450 mm diameter pipe and

(2) Determine an equivalent diameter for the pipe 2550 m long. (12)

14. (a) Three pipes of diameters 300 mm, 200 mm and 400 mm and lengths 450 m, 255 m and 315 m respectively are connected in series. The difference in water surface levels in two tanks is 18 m. Determine the rate of flow of water if coefficients of friction are 0.0075, 0.0078 and 0.0072 respectively considering (i) Minor losses also and (ii) Neglecting minor losses. (16)

Or

(b) A pelton wheel is to be designed for the following specifications. Power is 9560 kW; Head is 350 m; speed is 750 r.p.m; overall efficiency is 85% jet diameter is 1/6th of the wheel diameter; determine the following :

(i) The wheel diameter

(ii) Diameter of the jet and

(iii) Number of jets required. Take $C_N$ = 0.985 and speed ratio = 0.45. (16)

15. (a) A reaction turbine works at 450 r.p.m. under a head of 120 m. Its diameter at inlet is 1.2 m and the flow area is 0.4 $m^2$. The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with tangential velocity. Determine :

(i) The volume of flow rate

(ii) The power developed and

(iii) the hydraulic efficiency. (16)

Or

(b) A three throw pump has cylinders of 250 mm diameter and stroke length of 500 mm each. The pump is required to deliver 0.1 $m^3/s$ at a head of 100 m. Friction loss is 1 m in suction pipe and 19 m in delivery pipe. Velocity of water is delivery pipe is 1 m/s. Overall efficiency is 85% and slip is 3%. Determine :

(i) speed of the pump and

(ii) power required to run the pump. (16)

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