

B.E. FTBE EXAMINATION, 2012-13

(2nd Year, 1st Semester)

FLUID FLOW

Full Marks : 100

Time : Three Hours

Use a separate Answerscript for each Part.

The figures in the margin indicate full marks.

Answer **any five** question from Part I and Part II,
but not more than *three* from any Part.

Charts may be supplied .

Part - I

1. A pipe carrying oil of relative density 0.877 changes in size from 150 mm at Section A to 450 mm at Section B. Section A is 4m. lower than B and the pressure are 0.91 bar and 0.6 bar respectively. If the discharge is $0.15 \text{ m}^3/\text{s}$, determine the lost head and the direction of flow. 20
2. Develop the equation of continuity for steady flow of (a) a compressible fluid and (b) an incompressible fluid. 20
3. Write short notes on (**any two**) : 10×2
 - (i) Total energy balance for steady flow of fluid.
 - (ii) Friction losses in pipe fittings for fluids flowing through pipes.
 - (iii) Working principles of differential Manometer to measure of smaller pressure difference during Fluid Flow in pipes with a neat sketch.
4. Water at 15°C is pumped from a reservoir to the top of a mountain through a 6" pipe at an average velocity of 3.048 m/s. the pipe discharges into the atmosphere at a level of 1.219m, above the level in the reservoir. The pipe line itself is 1.524 km. long. If the overall efficiency of the pump and motor driving it is 70 per cent and if the cost of electrical energy to the motor is Rs.5 KW hr. What is the hourly energy cost for pumpins this water. Assume the necessary data. 20

[Turn over]

(2)

Part - II

5. Water at 15°C is pumped continuously through a horizontal pipe of 5 cm. dia. A recording flow meter indicates a flow of 3000 gals/hr. with a head of 44 cm. of water across the orifice with throat taps.

(i) What is the diameter of orifice meter

(ii) What will be the net loss in head due to the presence of the orifice when the flow is 2000 gals/hr. Given 1 gal = 4546 cm³. 20

6. Water is flowing through a 7.6 cm pipe at a rate of 150 gal/min. at 10°C.

(a) If a standard sharp-edged orifice 4.4 cm. dia is inserted in the line, what could be reading on a mercury manometer connected across the orifice.

(b) If a venturi meter with a throat 4.4 cm. in dia is used instead of orifice, what would be manometer reading?

(c) What would be the reading on each instrument if instead of water, an oil is flowing through the pipe at the same rate? Density and viscosity of oil are 0.89 gm/c.c. and 1.3 cp. 20

7. A centrifugal pump takes brine from the bottom of a supply tank and delivers it into the bottom of another tank. The brine level in the discharge tank is 50 m above that in the supply tank. The tanks are connected by 200 m of 18 cm pipe. The flow rate is 50 l/s. The line between the tanks has 2 gate valves, 4 steel Tμs and 4 ells. What is the energy cost for running this pump for a 24 hr. day?

Data given : $\rho = 1180 \text{ kg/m}^3$ $\mu = 1.2 \text{ m Pa.s}$

Energy cost Rs.4/kW hr. overall efficiency of the pump and motor is 60. $\frac{L}{D} = 7$ For

Gate valve, $\frac{L}{D} = 90$ For Tμs and $\frac{L}{D} = 32$ For ells. For pipe $\frac{e}{D} = \frac{4.0 \times 10^{-6}}{0.18}$. 20

8. Write short notes on (*any two*) : 10×2=20

(a) Fluidization operation for fine granular solid.

(b) Pumps generally used in food and biochemic industries with their functions.

(c) Viscosity and its importance in food industries.