(30)

Ref. No.: EX/FTBE /T/211/2017(S)

BACHELOR OF ENGINEERING (F.T.B.E) EXAMINATION, 2017
(2nd Year -1st Semester Supplementary)
Fluid Flow

Time: 3 hrs. Full Marks : 100

Part-I
[Answer any three questions; 3 x 20=60]

1. What do you mean by laminar and turbulent flow ? What do you mean by 'power law' model equation? Show the profile of 'shear stresses against 'shear rate' for different types of fluids citing example for each. What do you mean by 'eddies'?
In an air pipe line , the flow has the following conditions at section 1: temperature 25^0C, pressure 1.6 bar, velocity of flow 18 m/s, inside pipe diameter 50mm and at section 2: 25^0C, pressure 1.3 bar, inside pipe diameter 75mm. Calculate the mass flow rate of air and the velocity at section 2. At 25^0C and 1.6 bar pressure, air has density of 2.0 kg/m^3. (2+2+3+1+12)

2. Prove that velocity distribution with respect to radius of the flow pipe is a parabola for laminar flow of a Newtonian fluid through circular pipe. What are the basic objectives of using pipe fittings. Mention the 'equivalent resistance value' of 'Tee', '90^0 elbow', 'coupling' . (15+2+3)

3. (a) Determine the loss of pressure in overcoming the friction in a coil through which water flows with a velocity of 1.5 m/s. The coil is made of steel pipe with an internal diameter of 30mm. The diameter of a turn of the coil is 1 m. the number of turns is 10. The average temperature of the water in the coil is 30^0C. Assume here, density and viscousity of water as 998 kg/m^3 and 0.8 mPa-s.

   (b) Water at 21^0C (density = 1000kg/m^3 and viscousity = 1 mPa-s) is flowing with a velocity of 2 m/s in the annulus between a tube with an outer diameter of 25mm and another with an internal diameter of 50mm in a concentric tube heat exchanger. Calculate the pressure drop per unit length in the annulus. (12+8)

4. 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 (diameter 20 cm) pipe. The flow rate is 60 l/s . The line between the tanks has two globe valves , four standard tees and four 90^0 elbows. What is the energy cost for running this pump for a 24-h day? Assume density as 1180 kg/m^3 , viscousity as 1.2 mPa-s and energy cost Rs.0.80 /kW-h. Overall efficiency of the pump and motor is 60%. Neglect contraction as well as expansion losses at intake and delivery. (20)

5. (a) Water at 21^0C (density = 1000kg/m^3 and viscousity = 1 mPa-s) is flowing with a velocity of 3 m/s in the annulus between a tube with an outer diameter of 25mm and another with an internal diameter of 50mm in a concentric tube heat exchanger. Calculate the pressure drop per unit length in the annulus.

   (b) Determine the loss of pressure in overcoming the friction in a coil through which water flows with a velocity of 1.2 m/s. The coil is made of steel pipe with an internal diameter of 30mm . The diameter of a turn of the coil is 1 m. the number of turns is 10. The average temperature of the water in the coil is 30^0C. Assume here, density and viscousity of water as 998 kg/m^3 and 0.8 mPa-s, respectively. (8 + 12)

6. What do you mean by 'porosity' in a packed bed? Develop a relation between pressure drop and length of packing material for flow with very low Reynolds no. (less than 10).
A water softener consists of a vertical tube of 50 mm diameter and packed to a height of 0.5 m with ion-exchange resin particles. May be considered spherical with a diameter of 1.35 mm. water flows over the bed , because of gravity as well as pressure difference , at a rate of 400 ml/s. The bed has a porosity of 0.3. Calculate the frictional pressure drop. (2+6+12)

[Turn over

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BACHELOR OF ENGINEERING (F.T.B.E.) SUPPLIMENTARY EXAMINATION 2017

(2^{nd} Year-1^{st} Semester Supplementary)

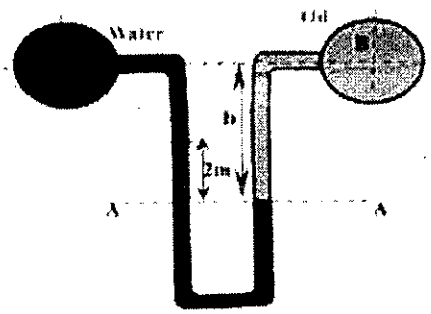
FLUID FLOW

Time: 3hrs | Full Marks: 100

Part-II

(Answer any two questions) 20×2 = 40

1. (a) Two pipes on the same elevation convey water and oil of specific gravity 0.88 respectively. They are connected by a U-tube manometer with the manometric liquid having-a specific gravity of 1.25. If the manometric liquid in the limb connecting the water pipe is 2 m higher than the other find the pressure difference in two pipes.



h = 5 m

(b) Write the basic principle of inclined tube manometer. What is its advantage?

© What is the differences between venture meter and orifice meter?

8+6+4 = 20

2. (a) Derive the venture meter coefficient from Bernoulli equation.
(b) Write the working principle of pitot tube.
© The lapse rate γ (= $-dT / dz$) is uniform in an atmosphere. Find the geopotential height of a pressure level p from the given values of sea level temperature and pressure.

8+5+7 = 20

3. (a) A Venturimeter is to fitted in a horizontal pipe of 0.15m diameter to measure a flow of water which may be anything up to $240m^3$/hour. The pressure head at the inlet for this flow is 18m above atmospheric and the pressure head at the throat must not be lower than

7m below atmospheric. Between the inlet and the throat there is an estimated frictional loss of 10% of the difference in pressure head between these points. Calculate the minimum allowable diameter for the throat.

(b) Applying body force and surface force derive the pressure at any point inside an incompressible fluid. 10+10 = 20