B.E (FTBE) 2ND YEAR-1ST SEMESTER EXAMINATION 2023
FLUID FLOW

Time : 3 hours Full Marks : 100\

(50 Marks for each Part)
Use separate Answer-script for each Part
PART I (50 Marks)

Answer any four questions (12.5 x 4= 50)

1. What do you mean by laminar and turbulent flow? Draw the profile of shear stress vs. shear rate for different types of fluids mentioning examples for each type. What is the dimension of Reynold's No.? Mention it's value in different flow regime. In a normal adult, the average speed of the blood through the aorta (radius r = 0.8 cm) is 0.33 m/sec. From the aorta, the blood goes into major arteries, which are 30 in number, each of radius 0.4 *cm*. Calculate the speed of the blood through the arteries.

2 + 3 + (1+1.5) + 5

2. What is a pump? What do you mean by 'prime mover'? Classify different types of pumps. Name the parts of a centrifugal pump. What do you mean by 'cavitation' & 'NPSH' and how are they related?

2 + 2 + 2.5 + 2 + 4

3. For the case where a Newtonian liquid is flowing in the laminar regime through a circular tube , show that the distribution of velocity across the cross section of the pipe is parabolic in nature. Find out the relation between average velocity and the maximum possible velocity for the same case. Show the position inside the tube where the point velocity of the liquid is equal to the average velocity

8 + 2 + 2.5

4. Write the objectives of using pipe fittings in flow line. With neat sketch show the following fittings: 90 degree elbow, coupling. Write short note on 'Moody Chart'. A horizontal pipe of non-uniform cross-section allows water to flow through it with a velocity 1 m/ sec when pressure is 50 kPa at a point. If the velocity of flow has to be 2 m/sec at some other point, what will the pressure at that point?

2 + 3 + 2 + 5.5

5. What do you mean by 'sphericity'? Deduce fanning friction factor (modified) for flow through packed bed. A cylindrical packed bed of 250 cm length has an internal diameter of 125 cm and is packed with silica particles of 1.25cm diameter. Bed porosity is 0.38. Air is flowing at a rate of 6kg /min. Determine the Pressure drop of air across the length. Viscousity and density of air are 10^{-2} m Pa-s and 10^{-3} gm/cc, respectively.

2 + 4.5 + 6

6. Give some applications of fluidization. Draw profile of pressure drop vs. velocity as well as bed height vs. velocity of a fluid flowing through a packed bed. Mention the minimum fuidization velocity on the profile as well. A packed bed consisting of 1.96 kg of solids of density of 2.8 g/cc, is contained in a

Cylindrical vessel of 10cm internal diameter and the height of 20 cm. The solid particle size is 500 micrometer. Water is being used to fluidize the bed. Find out the following :

(a) The volume of the vessel occupied by the bed (in ml)

(b) The volume of the solid in the vessel (in ml)

(c) The porosity inside the packed bed

(d) Minimum fluidization velocity (in ms^{-1})

(e) The type of fluidization that is likely to occur 2 + 3 + 7.5

7. An oil of viscousity 0.97 poise and relative density 0.90 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10m. Calculate the difference of pressure at the two ends of the pipe if 100 kg of oil is collected in a tank in 30 secs .

Find out the friction loss, if the inner diameter and length of the pipe are 0.3 m and 30 m respectively. Also, the friction factor and velocity of the liquid are 0.4 and 25 m per sec, respectively. 7.5 + 5

Ref. No.: Ex/FTBE/BS/B/T/215/2023

B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING
SECOND YEAR FIRST SEMESTER EXAM 2023

FLUID FLOW

Full Marks: 100 Time: 3 hrs

Part – II

Group-A

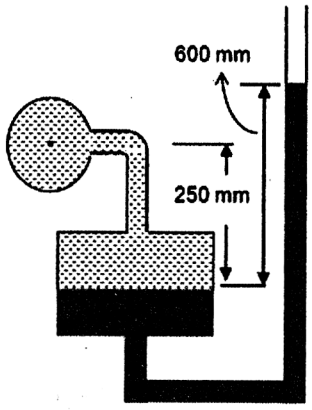
Answer any one question $1\times10 = 10$

1. Define gauge pressure, absolute pressure and write their correlation.
   A cylindrical vessel of 1.5m height and 5 cm^2 cross sectional area is filled with water upto a height of 1m and remaining with oil of specific gravity 0.8. the vessel is open to atmosphere. Calculate the absolute and gauge pressure on the base of the vessel in terms of (i) water head (ii) oil head and (iii) newton / m^2. Given the atmospheric pressure as 1.013 bar. Also calculate the net force experienced by the vessel base. 3+7 = 10
2. How do you estimate (using a device) the velocity profile of a fluid flowing in a circular pipe line. Write the working principle of that device. 4+6 =10

Group-B

Answer any two questions $2\times20 = 40$

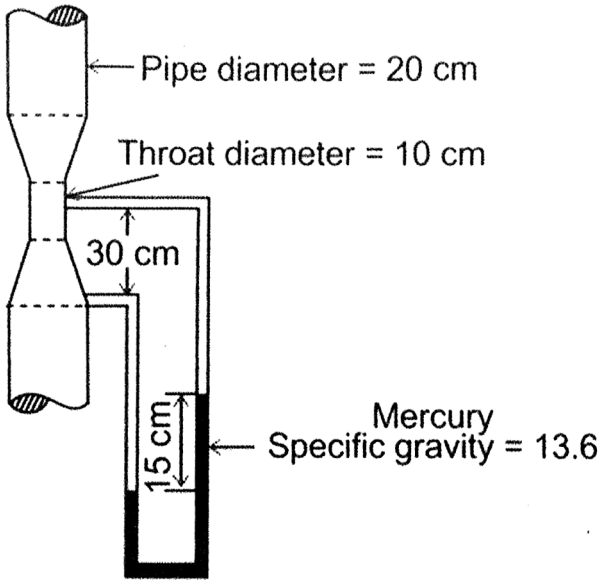
3. (a) What are the different types of manometers?
   (b) A vertical column micro manometer is connected to a pipe containing oil of specific gravity 0.92. The ratio of area of reservoir to that of vertical column is 150. Calculate the oil pressure in the pipe.



   (c) What is the advantage of inclined tube manometer? 5+10+5 = 20

4. (a) Mention the name of different flow measuring devices. Write short note on rotameter.

(b) A venturimeter as shown in the figure is connected to measure the flow of water in a vertical pipe of 20 cm diameter. Calculate the water flow rate. Given constriction ratio of the pipe is 0.5 and venturimeter coefficient is 0.96.



3+5+12+ =20

5. (a) Derive the expression for theoretical volumetric flow rate in orifice meter. Why the value of venturimeter coefficient is greater than orifice meter coefficient?

(b) Given the atmospheric pressure at sea level as 760 mm Hg, temperature 150C and density 1.225 kg/m^3, estimate the pressure on the top of the mount Everest corresponding to an altitude of 8848 meters. Neglect variation in the value of g.

7+3+10 = 10