

## BACHELOR OF ENGINEERING ( F.T.B.E) EXAMINATION, 2018

(2<sup>nd</sup> Year -1<sup>st</sup> Semester )**Fluid Flow**

Time: 3 hrs.

Full Marks : 100

Use separate answer script for each part

Part-I

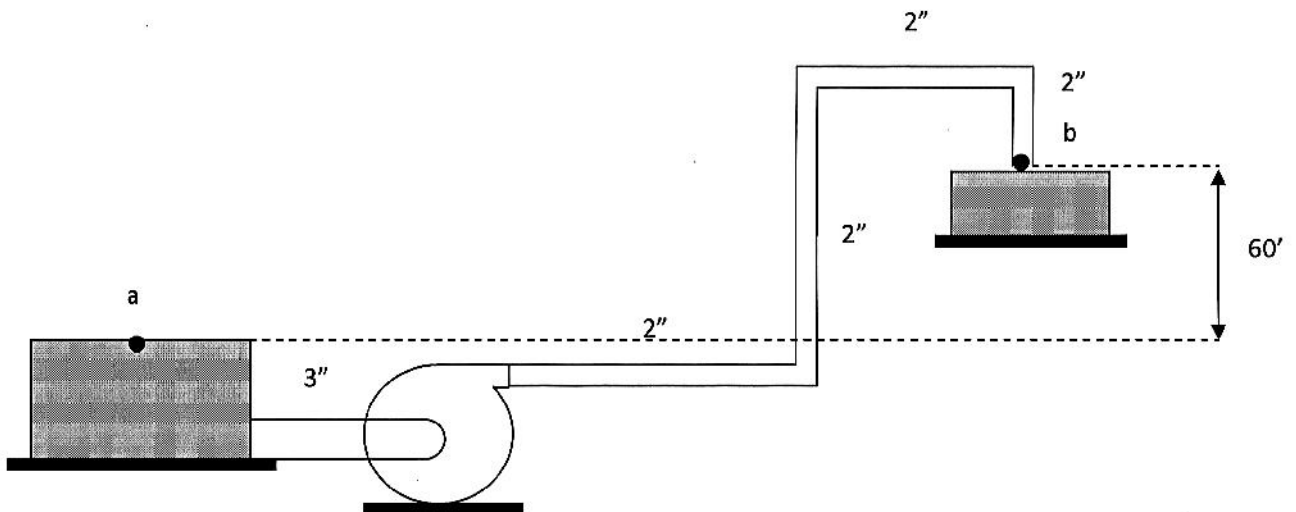
[Answer any four questions; 4 x 15=60]

1. 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.

In an air pipe line , the flow has the following conditions at section 1: temperature 25<sup>0</sup>C, pressure 1.7 bar, velocity of flow 18 m/s, inside pipe diameter 50mm and at section 2: 25<sup>0</sup>C, pressure 1.2 bar, inside pipe diameter 75mm. Calculate the mass flow rate of air and the velocity at section 2. At 25<sup>0</sup>C and 1.7 bar pressure, air has density of 2.2 kg/m<sup>3</sup>.

(2+3+10)

2.



In the figure , shown above, a pump draws a solution , sp. Gravity 1.8, from a storage tank through 3 inch steel pipe. The efficiency of the pump is 60%. The velocity of the flow in the suction line is 4 ft/sec. The pump discharges thorough a 2 inch steel pipe to an overhead tank. The end of the discharge pipe is 60ft above the level of the solution in the feed tank. Friction loss in the entire piping system is 10 ft-lb<sub>f</sub> / lb<sub>m</sub>. What pressure must the pump develop in lb<sub>f</sub> per sq. inch. What is the horse power of the pump ? ( 15 )

3. A long plastic tube with an inside diameter of 0.5 mm is connected to faucet where the pressure of water is 100 kPa above atmospheric. Estimate the length of the tube so that the delivery is 3.0 l/day. The inlet and delivery ends of the system are at ground level. Assume  $\rho = 1000 \text{ kg/m}^3$  and  $\mu = 1 \text{ mPa}\cdot\text{s}$  (15)
4. The velocity distribution with respect to radius of the flow pipe is a parabola for laminar flow of Newtonian flow through circular pipe-prove. What is the basic objectives of using pipe fittings. (12+3)

[ Turn over

5. 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 60 m above that in the supply tank. The tanks are connected by 200 m of 15cm pipe. The flow rate is 45 l/s. The line between the tanks has four standard tees and four 90° elbows. What is the energy cost for running this pump for a 24-h day? Assume density as  $1150 \text{ kg/m}^3$ , viscosity as  $1.2 \text{ mPa-s}$  and energy cost Rs.0.90 /kW-h. Overall efficiency of the pump and motor is 60%. Neglect contraction as well as expansion losses at intake and delivery. (15)
6. 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 40 mm diameter and packed to a height of 0.5 m with ion-exchange resin particles. May be considered spherical with a diameter of 1.3 mm. water flows over the bed , because of gravity as well as pressure difference , at a rate of 250 ml/s. The bed has a porosity of 0.3. Calculate the frictional pressure drop. (7+8)
7. Advantages and disadvantages of 'fluidization' in industrial applications. Show the variation of bed height and pressure drop with fluid velocity for the case of packed as well as fluidized bed. Benzene at  $20^\circ\text{C}$  ( density =  $894 \text{ kg/m}^3$  and viscosity =  $6.2 \times 10^{-4} \text{ Pa-s}$  ) is being pumped through 50 m of a straight pipe of 25 mm diameter with a velocity of 3 m/s. The line discharges into a tank 25 m above the pump. Calculate the pressure gauge reading at the discharge side of the pump. (2+3+10)

-END-

Ref. No. : Ex/FTBE/T/211/2018

**B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING  
SECOND YEAR FIRST SEMESTER - 2018**

Subject : **FLUID FLOW**

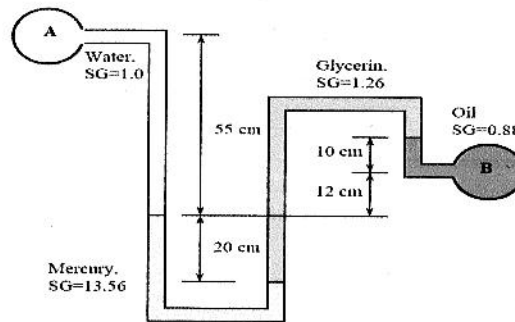
Time : 3 hours

Full Marks : 100

**Part -****Use Separate Answer scripts for each Group****Answer any two questions****20×2 = 40**

- Derive an expression for change in pressure with fluid column height in atmosphere.
  - Define pressure head. An oil of specific gravity 0.8 is under pressure of 137.2 kPa, then determine pressure head expressed in terms of meters of oil.

© The cruising altitudes of subsonic and supersonic aircraft are 12 km and 20 km respectively. What is the relative difference in air pressure between these two altitudes? 7+6+7 = 20
- Classify different pressure measurement devices.
  - The pressure difference between two pipes is measured by a double-fluid manometer. For given fluid heights and specific gravities, calculate the pressure difference between the pipes. 8+12 = 20



- Classify different flow meters.
  - A pitot tube with coefficient of 0.93 is used to measure the velocity of air in a pipe. The measured differential pressure is 300 mm. What is the velocity of air in the pipe?

© Determine the volumetric flow of water in  $\text{m}^3/\text{hr}$  flowing in a pipe having a diameter of 40 mm through an orifice having a diameter of 20 mm. Manometer reading across the tapping is 15 cm of Hg. Assume correction factor = 1 and density of water is  $1000 \text{ kg/m}^3$ .