FPT-401/EFEngg-II/4th Sem/2014/N/C

ELEMENTS OF FOOD ENGINEERING - II

Full Marks – 70

Pass Marks – 28

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) State Newton's law of viscosity. What are Newtonian and non-Newtonian fluids ?

    2+4=6

    (b) One litre of crude oil weighs 10N. Calculate the 6

    (i) specific weight

    (ii) density

    (iii) specific gravity.

    (c) What are the steady and uniform flow of fluids ? 2

2. (a) Define the term 'discharge of fluid'. Derive the following relation for incompressible flow of fluid, $A_1 V_1 = A_2 V_2$ where $A_1 A_2$ and $V_1 V_2$ are the areas and fluid velocities at section 1 and 2 of a pipe respectively.

$$2+4=6$$

(b) A 30 cm diameter pipe carries oil of specific gravity 0.8 at a velocity of 2m/s. At another section the diameter is 20 cm. Find the velocity at this section and also mass flow rate of oil. 8

3. (a) State Bernoulli's theorem. Mention any two devices which are used to measure the flow rate of fluid through a pipe. $2+2=4$

(b) A pipe line carrying cow milk (specific gravity = 1.065) changes in diameter from 300 mm diameter at position 1 to 500 mm diameter at position 2 which is 3 metres at the higher level. If the pressure at 1 and 2 are 100 kN/m² and 60 kN/m² respectively and the discharge is 0.2 m³/s, determine loss head. (2) 10
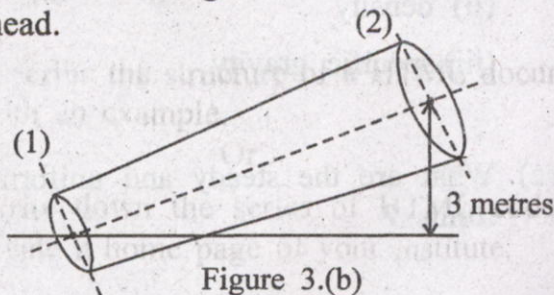

(1)

3 metres

Figure 3.(b)

4. (a) What is the use of a pitot tube ? Mention the main components of a venturimeter.

$1+3=4$

(b) Derive the expression for actual discharge (Q_{act}) of a fluid flowing through a horizontal venturimeter, which is given by 10

$$Q_{act} = C_d \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \sqrt{2gh}$$

where C_d = coefficient of discharge

A_1 = area of the inlet

A_2 = area of the throat

h = difference of pressure head at the inlet and outlet

g = acceleration due to gravity.

5. (a) What is Reynold's number ? What are the Reynold's numbers for laminar, transient and turbulent flow through a pipe ? $2+2=4$

(b) Orange juice is passing through a pipe of diameter 2.625 cm. The density of orange juice is 1.05×10^3 kg/m³ and its viscosity is 2.5×10^{-3} Pa. sec. The volumetric flow rate of the juice is 60 lpm. Calculate the Reynold's number and find whether the flow is laminar or turbulent. 5

(c) Explain the working principle of a double acting reciprocating pump. 5

6. (a) Define the following terms : 2×4=8

    (i) Moist air

    (ii) Wet Bulb Temperature (WBT)

    (iii) Mass transfer

    (iv) Mas fraction.

(b) The Dry Bulb Temperature (DBT) of atmospheric air in a place is 25°C and its specific humidity is 0.01 kg|kg of air. Determine the following : 6

    (i) Partial pressure of vapour

    (ii) Relative humidity.

Take, atmospheric pressure = 1 bar and saturated pressure at 25°C = 3.169 kPa.