M.Sc. 1st Semester Examination, 2012

CHEMISTRY

(Industrial Chemistry)

PAPER — CEM- 104

Full Marks : 40

Time : 2 hours

Answer any **four** questions

The figures in the right hand margin indicate marks

1. (*a*) What is meant by a fluid ? What are Newtonian and non-newtonian fluids ? With examples define different non-newtonian fluids.

   (*b*) For an ideal gas derive the barometric equation correlating pressure and height.   5 + 5

2. (*a*) A manometer is inclined at an angle of $45°$ to the horizon and is measuring the pressure drop between two sections of a tube conveying air. The manometric fluid is water. The reading of the manometer is 1 cm. What is the pressure difference between the two points ?

(b) Two liquids are there having different densities and they are not miscible with each other. How these two fluids can be separated ? $5 + 5$

3. (a) What are laminar and turbulent flows ? How can you differentiate between the two ?

(b) From the following expression can you find out the expression for volumetric flow rate of a Newtonian fluid flowing through a tube.

$$\frac{d}{dr}(r\tau) = \left(\frac{\Delta P}{l} r \right),$$ where, τ represents shear stress and ΔP represents pressure drop. $5 + 5$

4. Describe an instrument with which you can measure the flow rate of a liquid. 10

5. Methane is burnt with 10% excess air in a burner. 10% of methane forms CO and the rest CO_2. What is the composition of product gas (flue gas) ? What will be its volume at the combustion temperature of $600°C$? 10

6. (a) What is Bernoulli equation ? What will be the modification if a pump is used in between ?

(b) How pressure drop in a pipeline carrying water is correlated with friction factor, f ? Derive the expression.   3 + 7

7. What are the different modes of heat transfer, and what are their expressions ? The inside wall of a brick lined furnace is maintained at $800^{\circ}C$ and the outside is at a temperature of $50^{\circ}C$. The thickness of the wall is 20 cms and the heat loss from the wall is 300 W/m^2. What is the value of thermal conductivity ?   5 + 5

8. What is meant by filtration ? Describe the function of an industrial filter.   10