

Seat No. : \_\_\_\_\_

**FS(R)-15**  
**April-2007**  
**Industrial Chemistry**  
**(Vocational)**  
**Paper – II**

**Time : 3 Hours]**

**[Max. Marks : 70**

**Instruction :** All questions carry equal marks.

[At. Wt:– H → 1, C → 12, N → 14, O → 16, Na → 23, P → 31, S → 32, cl → 35.5, K → 39]

1. (a) Define : Molality, Equivalent weight, Work.
- (b) A solution of caustic soda in water contains 20% NaOH by weight at 60 °C. The density of the solution is 1.196 kg/lit. Find the molarity, normality and molality of the solution.
- (c) Explain : (1) Average Molecular weight and (2) Density of Gas Mixture.

**OR**

- (a) Define : Weight fraction, Pressure, Force.
  - (b) Ethanol and water forms an azeotrope containing 96% ethanol by weight. Find the composition of azeotrope by mole percent.
  - (c) In a textile mill a double effect evaporator system concentrates weak liquor containing 4% NaOH by weight to produce a lye containing 24% solid by weight. Calculate the evaporation of water per 100 kg feed in the evaporator.
2. (a) Define : Unit operation, process flow sheet, Tie material.
  - (b) Soyabean seeds are extracted with hexane. The seeds contain 18.6% oil, 69.0% solid and 12.4% moisture. At the end of the process, cake(meal) is separated from hexane oil mixture. The cake contains 0.8% oil, 87.7% solids and 11.5% moisture. Find the percentage recovery of oil. All % are by weight.
  - (c) Explain (1) Evaporation and (2) Filtration operation with block diagram used to solve material balance problems.

**OR**

- (a) Define : Stoichiometric coefficient, Excess reactant, % yield.

- (b) Monochloroacetic Acid (MCA) is manufactured in a reactor by the action of glacial acetic acid with chlorine gas at 100 °C in the presence of  $\text{PCl}_3$  catalyst. MCA thus formed will further react with chlorine to form Dichloroacetic Acid (DCA). To prevent the formation of DCA, excess acetic acid is used.

A small scale unit which produce 5000 kg/day MCA requires 4536 kg/day chlorine gas which also result in 263 kg/day formation of DCA. Find % yield, % conversion and selectivity of MCA production.

3. (a) Define : Purge ratio, Heat of combustion, Heat capacity.  
(b) A stream of nitrogen flowing at a rate of 100 kg mole/hr is heated from 30 °C to 100 °C, Calculate the heat that must be transferred, if  $C_p^0$  for  
Nitrogen =  $6.457 + 1.389 \times 10^{-3} T - 0.069 \times 10^{-6} T^2$ .  
(c) What is saturated and supersaturated solution ? Explain one crystallizer with diagram.

**OR**

- (a) What is distillation ? Explain steam distillation.  
(b) Define Adsorption. Explain fixed bed adsorption process for solvent recovery.  
(c) What is Hard water ? Explain any one water softening process.
4. (a) Define : Calorific value. Explain Bomb Calorimeter.  
(b) What is Fuel Oils ? Discuss any one boiler with diagram.  
(c) Explain characteristics of a good fuel.

**OR**

- (a) Write a note on applications of Evaporation in industry.  
(b) What is Filtration ? Explain Nutsche filter.  
(c) Write a note on : Spray dryer.
5. Answer any **three** of the following :
- (a) Give a brief account on various raw material used for the manufacture of glass.  
(b) Define Polymers. Give a brief account of polymer processing by Injection moulding machine.  
(c) Write a note on vacuum pumps.  
(d) Define extraction. Write a note on spray tower extraction with diagram.  
(e) Write a note on Refrigeration.