O.C.

C 124

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Third Semester

Bio–Technology

BT 1201 — PRINCIPLES OF CHEMICAL ENGINEERING

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the dimensions and units for pressure and force in S.I. system.

2. What is the principle in fitting the data by 'least squares' technique?

3. What do you understand by steady state and unsteady state operations? Give examples.

4. Explain the terms by pass and recycle with a sketch.

5. What is the enthalply of a mixture of gas of specific heat 'C_A' and vapor of specific heat 'C_B' if the mixture is at a temperature 't_G'. The more fraction of vapor is 'x'.

6. State and explain 'Raoult's law'.

7. Define stream line and stream tube.

8. Define Reynolds number and indicate its significance.

9. What is fluidisation?

10. Name any four pumps used in Industries.

PART B — (5 × 16 = 80 marks)

11. (i) Determine methods of plotting the variables in the following equations so that data fitting the equations will fall on straight lines from which the values of the numerical constants can be computed.

(1) $y = \dfrac{x}{a + bx}$

(2) $y = a + bx + cx^2$. (4 + 4)

(ii) The following table gives the velocity 'v' of a particle at time 't'.

t (secs)	0	2	4	6	8	10	12
v (m/s)	4	6	16	34	60	94	136

Find the distance moved by the particle in 12 secs and also the acceleration at t = 2 secs. (8)

12. (a) (i) A cotton mill dries a water soaked fabric in drier from 54% to 9% moisture. How many kg. of water are removed by drying operations per 1200 kg. of feed. (4)

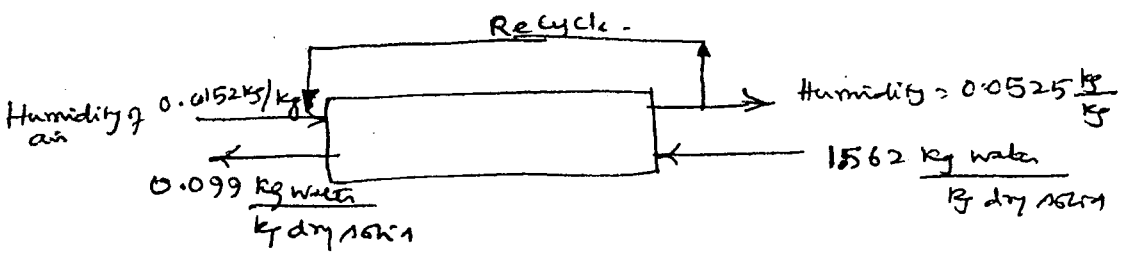
(ii) A tank contains H_2SO_4 acid of concentration 12.43%. If 200 kg. of 77.7%. H_2SO_4 is added and final acids is 18.63% in the tank, how many kg. of weak acid have been used. (6)

(iii) What is the weight of iron and water required for the production of 100 kg. of hydrogen? (6)

Or

(b) (i) A mixture of acetone vapour and nitrogen contains 14.8% acetone by volume. Calculate the relative humidity, % humidity and humidity (of acetone vapour) at 20°C at 745 mm Hg. vapour pressure of acetone at 20°C = 184.8 mm of Mercury. (8)

(ii) In the diagram shown below, what fraction of dry air leaving is recycled for 1 kg. of dry solid entering. (8)



13. (a) (i) Explain heat of reaction, heat of combustion Hess's law and Kopp's rule. (10)

(ii) Calculate the amount of heat given off when 1 m^3 of air at standard conditions cools from 500°C to –100°C at constant pressure (6)

$$Cp_{air} = 6.386 + 1.763 \times 10^{-3} T - 0.2656 \times 10^{-6} T^2.$$

$$\left(C_p = S_p . \text{ ht in } \frac{\text{K Cal}}{\text{Kmol } ^\circ\text{K}} \text{ and } T : \text{ink} \right)$$

Or

(b) (i) Explain Clausius – Clapeyron equation and Watson's equation. (6)

(ii) Discuss how the adiabatic flame temperature is estimated for the combustion of methane with 20% excess air. (10)

14. (a) (i) Show that pressure at any point is independent of direction. (10)

(ii) Derive Barometric equation. (6)

Or

(b) (i) Explain Newtonian and Non–Newtonian fluids with suitable shear stress–velocity gradient sketches. (6)

(ii) Explain :

(1) Reynolds stress

(2) Nature of turbulence and

(3) Intensity and scale of turbulence and

(4) Isotropic turbulence. (10)

15. (a) (i) Discuss the advantages and disadvantages of fluidization. (8)

(ii) Obtain expressions for work (1) in adiabatic compression and (2) in ISO thermal compression. (8)

Or

(b) (i) Explain the classification of fluid moving machineries. (4)

(ii) Discuss the working of a centrifugal pump with a neat sketch. (8)

(iii) Explain briefly characteristic curves of a centrifugal pump. (4)
