Register Number: ……..

B.TECH DEGREE EXAMINATIONS: APRIL/MAY 2014

(Regulation 2009)

Third Semester

BIOTECHNOLOGY

BTY106 : Principles of Chemical engineering

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Physical quantities are divided into
   a) 3 groups b) 2 groups
   c) 1 group d) 5 group
2. An ideal solution is the one which obeys
   a) Raoult's law b) Amagat's law
   c) Charles law d) Daltons law
3. Input=output is valid
   a) For system without chemical reaction b) For system at Steady State with chemical reaction
   c) For system at Steady State without chemical reaction d) There is no accumulation and loss
4. A recycle ratio is defined as
   a) Recycle stream/ gross feed stream b) Recycle stream/fresh feed stream
   c) gross feed stream/ recycle stream d) Fresh feed stream / recycle stream
5. Total energy at a point consists of
   a) Internal energy b) Potential energy
   c) Kinetic energy d) all
6. $\Delta H^{o}_{R} = \Delta H^{o}C$ (reactant) - ΔH^{o}_{C} (Product) it is to be
   a) Standard heat reaction b) Standard heat of formation
   c) Heat of summation d) Heat of capacity
7. Flow of incompressible fluid with no shear is called --------
   a) Creep flow b) Streamline flow
   c) Potential flow d) Boundary layer flow
8. The relation between friction factor (f) and Reynolds number (Re)is given by laminar flow
   a) f= 4/ Re b) f=16/Re
   c) $f=Re^{0.5}$ d) $f= 0.0014+Re^{0.32}$
9. The most ideal device for the transportation of medium viscous lubricating oil is a
   a) Plunger pump b) Piston pump
   c) Centrifugal pump d) Vane pump
10. The operating range of fluidization velocities for all particle sizes are
    a) Almost the same b) Much greater with small particles
    c) Greater with small particles d) Greater with larger particles

PART B (10 x 2 = 20 Marks)

11. Find the moles of oxygen present in 500 gm.
12. State and explain the Boyle's and Charle's law.
13. Define limiting reactant and excess reactant .
14. Draw a block diagram for recycle operation and purging operation
15. Define heat capacity of gases at constant pressure .
16. State and explain the enthalpy changes in reaction with different temperatures.
17. What is the significance of Reynolds number?
18. List out the different manometers
19. What is cavitation?
20. Which type of pumps are suitable for handling corrosive liquids and why?

PART C (5 x 14 = 70 Marks)

21. a) (i) Sodium Chloride weighing 200 kg is mixed with 600 kg potassium Chloride Calculate the Composition of the mixture in (i) Weight % (ii) mole % (7)
    (ii) Calculate the density of air containing 21% O_2 , 79% N_2 by volume at 503 K and 1519.875 kpa. (7)

(OR)

b) (i) Ideal gas mixture contains 40% N_2 , 30% CO and 30% H_2 by volume at P= 202.65kpa and 338K .Calculate (a) the partial pressure of each component. (b) the mass fraction of nitrogen (c) the average molecular weight of the gas and (d) the density of gas (g /L) (7)

(ii) A gaseous mixture has the following composition by volume: 66 % N_2, 8 % CO_2, O_2 6%, CO 14%,CH_4 1% and H_2O 5%. Calculate (i) Average molecular weight of the gas mixture and (ii) Density of the gas mixture at 303 K and 101.325 kPa. (7)

22. a) (i) A single effect evaporator is fed with 10000 kg/hr of weak liquor containing 15% caustic by weight and is concentrated to get thick liquor containing 40% by weight caustic (NaOH). Calculate (a) Kg/h of water evaporated and (b) kg/h of thick liquor obtained. (4)

(ii) The waste acid from a nitrating process containing 20%HNO_3, 55% H_2SO_4 and 25% H_2O by weight is to be concentrated by addition of concentrated sulphuric acid containing 95% H_2SO_4 and concentrated nitric acid containing 90% HNO_3 To get desired mixed acid containing26% HNO_3 and 60% H_2SO_4.Calculate the quantities of waste and concentrated acids required for 1000 kg of desired mixed acid. (10)

(OR)

b) (i) The waste acid from a nitrating process containing 23%HNO_3, 57% H_2SO_4 and 20% H_2O by weight.This acid to be concentrated to contain 60% H_2SO_4 and 27% HNO_3 by the addition of concentrated sulphuric acid containing 93% H_2SO_4 and concentrated nitric acid containing 90% HNO_3.Calculate the amount in kg of waste and concentrated acids that must be combined to obtain 1000 kg of desired mixture. (10)

(ii) A tray dryer is fed with 1000kg of wet orthonitroaniline containing 10% water. The desired product contains 99.5% orthonitroaniline(ONA) and the rest water. Find the percentage of original water that is removed in the dryer. (4)

(**OR)**

23 a) (i) Derive the Empirical Equation for heat Capacities. (4)

(ii) Pure ethylene is heated from 303K (30ºC) to 523 K at atmospheric pressure. Calculate the heat added per Kmol ethylene using the heat capacity data given below.$C^o_p = 4.1261 + 155.0213x10^{-3}T - 81.5455x10^{-6}T^2 + 16.9755 x10^{-9}T^3$ (10)

(**OR)**

b) (i) Give the definition for the following terms:Standard heat of formation , heat of reaction , heat of combustion . (4)

(ii) Calculate the standard heat of reaction $\Delta H^o_{R,}$ of the following reaction. (10)

$CH_3Cl(g) + KOH(s) \rightarrow CH_3OH + KCl(s)$.

Components	$\Delta H^o_{R,}$ KJ/mol at 298.15 K (25ºC)
$CH_3Cl(g)$	-102.936
KOH (s)	--239.2
$CH_3OH(l)$	--424.764
KCl(s)	-436.747

24 a) (i) Describe the various types of fluids and its properties (7)

(ii) Explain the U-tube manometer working principles with neat sketch (7)

(**OR)**

b) Derive the Bernoulli equation and continuity equation

25 a) (i) Describe the characteristics of centrifugal pump with diagram? (7)

(ii) Discuss the fluid properties measurements (7)

(**OR)**

(i) Differentiate between centrifugal pump and reciprocating pump (7)

(ii) Write short notes on fluidization. (7)

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