Register Number: …….

B.TECH DEGREE EXAMINATIONS: NOV/DEC 2010

Third Semester

BIOTECHNOLOGY

U07BT308: Principles of Chemical Engineering

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

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. If a ball is droped from a height of 0.2 m with acceleration due to gravity 9.8m/sec^2, the mass of a ball is 10kg, the potential energy will be

   A) 19.6 J B) 196 J C) 1.96 J D) 100J

2. The term PCS in process automation is

   A) process constant system B) process control system

   C) pressure control system D) none

3. A sample of caustic soda contains 40ppm of silica as impurity. The percentage of impurity in the sample is

   A) 0.4 B)0.04 C) 0.004 D) 0.0004

4. A process which changes with respect to time is

   A) Unsteady state B) steady state C) equilibrium D) both (a) and (b)

5. The quantity of heat absorbed or released by a substance undergoing a change of state, such as ice changing to water or water to steam, at constant temperature and pressure is called

   A) Latent heat B) Sensible heat C) Thermal energy D) Potential energy.

6._____ generally cannot flow spontaneously from a material at lower temperature to a material at higher temperature.

   A) heat B) liquid C) solid D) gas

7. A liquid which does not flow at all until a threshold stress is attained is

   A) pseudoplastic B) Bhingham plastic C) dilatent D) thixotropic

8. Under ordinary conditions the flow in a pipe or tube is turbulent when Reynolds number is above

   A) 2100 B) 4000 C) 6000 D) 10,000

9. Range of N_{Re} value for turbulent flow

   A) 200-400 B) 2000-6000 C) 2000-4000 D) 20,000-40,000

10. Velocity head of the liquid from the impeller is converted into pressure head in _____pump

    A) Centrifugal B) Rotary C) Plunger D) Diaphragm.

PART B (10 x 2 = 20 Marks)

11. Write the simpsons rule.
12. For NTP conditions at 273.15K and 101.325kPa find the volume occupied by 1kmol of gas
13. What do you understand by steady state and unsteady state operation ? give example
14. What is the role of humidity chart?
15. Differentiate sensible heat and latent heat.
16. State Kelvin plank statement.
17. Define kinematic viscosity .
18. Prove that Reynolds number is dimensionless.
19. Define zero –head flow rate in a centrifugal pump.
20. What is meant by NPSH in a pump.

PART C (5 x 14 = 70 Marks)

21. a) (i) Fit a curve of the form $xy= a+bx^2$ to the following data by the method of least square. (7)

x	1	2	4	6	8
y	5.43	6.28	10.38	14.86	19.51

(ii) Discuss in detail about curve fittings. (7)

(OR)

b) Make the following conversions .

(a) 294 g/l H_2SO_4 to normality

(b) 4.8mg/ml $CaCI_2$ to normality

(c) 5 N H_3PO_4 to g/l

(d) 54.75 g/l HCl to molarity

(e) 3 M $K_2 SO_4$ to gm /lit

Data: Molecular weight of H_2SO_4 =49, $CaCI_2$ =55.5, H_3PO_4=49, $K_2 SO_4$ =174

22. a) (i) Write short notes on (7)

(a) Relative humidity (b) Specific humidity (c) Humidity chart (d) Dew point.

Draw and explain the general material balance for (7)

(a) Distillation column (b) Extraction (c) Evaporation

(OR)

b) In the Deacon process for the manufacture of chlorine a dry mixture of hydrochloric acid gas and air is passed over a heated catalyst which promotes oxidation of acid. Air is used 30% in excess of that theoretically required. kg of the acid. (Atomic weight of chlorine = 35.5, air contains 23.2% oxygen by weight) .

Reaction : $4\ HCL + O_2 \rightarrow 2Cl_2 + 2H_2O$.

Calculate the following

(i) The weight of air supplied per kg of acid.

(ii) The composition (weight %) of gases entering.

(iii) The composition (weight %) gases leaving, assuming that 60% of acid is oxidized in the process.

23. a) (i) Toluene is heated from 290 k to 350 k. Calculate the heat required to be added to toluene using heat capacity data given below. (10)

$Cp = a + bT + cT^2 + dT^3$, kJ/kmol, for n = 0.0027 moles

Component	a	b x 10^3	c x 10^6	d x 10^9
Toluene	1.8083	812.223	1512.67	1630.01

(ii) Derive the empirical equation used to solve the above problem. (4)

(OR)

b) (i) Develop an expression for the mathematical statement of Second Law of thermodynamics. (7)

(ii) Explain in detain the procedure to solve the problems in steady state and unsteady state conditions. (7)

24. a) (i) Show that in a laminar flow the velocity distribution with respect to radius is a parabola with the apex at the centerline of the pipe. (10)

(ii) State Hagen Poiseuille equation and its application. (4)

(OR)

b) (i) Discuss in detail about head losses for various station when fluid flows through a pipe line. (7)

(ii) Derive barometric equation for estimating the pressure distribution. (7)

25. a) Write short notes on

(i) NPSH and Cavitation (ii) Positive displacement compressor (iii) Priming.

(OR)

b) (i) Distinguish between particulate and aggregate fluidization (7)

(ii) Derive an expression for minimum fluidization velocity. (7)

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