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**2007 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY**

II B.TECH I SEMESTER REGULAR EXAMINATIONS, NOVEMBER 2007

**BIO CHEMICAL THERMODYNAMICS**  
(BIO-TECHNOLOGY)

SET NO -4  
NOVEMBER 2007

TIME: 3 HOURS  
MARKS: 80

Answer any FIVE Questions  
All Questions carry equal marks

1. (a) Classify the following into intensive and extensive property with suitable explanation:-

- i. Total mass,
- ii. Volume
- iii. Molecular weight
- iv. Density
- v. Heat
- vi. Temperature

(b) Define reversible process with suitable example. [8+8]

2. It is desired to design a tank to store 10Kmol methane at 6.0 MPa and 300K. Determine the size of the tank using the Redlich-Kwong equation of state. The critical constants of methane are  $P_C = 4.6\text{MPa}$  and  $T_C = 190.6\text{K}$ . [16]

3. (a) Give an example of a fundamental relation.

(b) What is an equation of state? How many equations of state are there for a single component of simple compressible substance? [6+10]

4. Prove the following.

(a)

-

$V_i d$

$$i = V_i \quad [4]$$

(b)

-

$H_i d$

$$i = H_i \quad [4]$$

(c)  $V_i d = P$

$I x_i V_i$  [4]

(d)  $H_i d = P$

$I x_i H_i$  [4]

5. (a) List the conditions under which Raoult's law is valid for VLE. Show that for above conditions.  $y_i P = x_i P_{sat i}$  ( $i = 1, 2, \dots, N$ )

(b) Whether conditions under which, Raoult's law is valid for VLE are realistic? Which condition is not realistic. Discuss modified Raoult's law. [8+8]

6. The equilibrium constant for the reaction,  $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$ , at 400K is 1.737 suppose a reactor which is maintained at 1 Mpa and 400K is fed with a stoichiometric mixture of CO and  $H_2$ , estimate the equilibrium mixture.

7. (a) Explain the Gaden classification from stoichiometric point of view the product formation in fermentation processes.

(b) The following stoichiometric equation describes penicillin synthesis:  $1.5 \text{ Glucose} + H_2SO_4 + 2NH_3 + \text{phenylacetate} \rightarrow \text{Pencillium G} + CO_2 + 8H_2O$  the theoretical yield of penicillin is 1.2g (gram of glucose). Find out the molecular weight of penicillin G. [16]

8. Write Short notes

(a) Respiratory Quotient

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