R09

Code No: 54050

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, December - 2017
THERMODYNAMICS FOR BIOTECHNOLOGISTS
(Biotechnology)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) Is it possible to prove the laws of thermodynamics? Describe in brief.
b) One mole of an ideal gas at 1.0MPa and 310K is heated at constant temperature till the volume is doubled again. Calculate the work done by the gas. [7+8]

2. It is desired to design a tank to store 10Kmol methane at 6MPa and 300K. Determine the size of the tank using the Redlich Kwong equation of state. The critical constants of methane are Pc = 4.6MPa and Tc = 190.6K. [15]

3. A particular thermodynamic system has the following equations of state.
1/T = 5NR/2U; P/T = NR/V ;Obtain the third equation of state of the system. [15]

4. Prove the following [8+7]
a) $f_i' = f_i^{sat} = \Phi_i^{sat} P_i^{sat}$
b) $f_i = \Phi_i^{sat} P_i^{sat} \exp[V_i^l (P-P^{sat})/R.T]$

5. For the equilibrium state of a chemical reaction, show that $-RT \ln K = \Delta G_o$. [15]

6.a) Define reaction coordinate. What is its usefulness?
b) For a system in which the following reaction occurs $CH_4 + H_2O$ ---> $CO + 3H_2$, assume there are present initially 2mol CH_4, 1mol H_2O, 1mol CO and 4mol H_2. Determine expressions for the mole fraction y_i as function of Є [5+10]

7. Explain VLE with the help of T-x-y and P-x-y diagrams. [15]

8. Discuss about evaluation of equilibrium constants and effect of pressure and temperature on it. [15]

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