

Code: 9A23404

B.Tech II Year II Semester (R09) Supplementary Examinations December/January 2015/2016

THERMODYNAMICS IN BIOPROCESS SYSTEMS

(Biotechnology)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 (a) What you understand about the term temperature?
(b) Discriminate intensive and extensive properties with suitable example.
(c) What is the relation b/w enthalpy and internal energy?
- 2 (a) Discuss how limitations of first law disappear in second law of thermodynamics.
(b) A Carnot engine (i) Operates between two reservoirs at temperature 1920 K and T° K while a second Carnot engine. (ii) Operates between T° K and 302 K. It is found that both the engines have the same efficiency. Determine the value of T.
- 3 (a) Derive fundamental property relation and explain its significance.
(b) Explain and describe the Raoult's law and also mention the limitations.
- 4 (a) State and explain Gibb's theorem.
(b) Derive an equation to find the fugacity and fugacity co-efficient of a gas from its compressibility factor data.
- 5 (a) Show that $\left(\frac{\partial P}{\partial T}\right)_V = \left(\frac{\partial S}{\partial V}\right)_T$
(b) A system has the equation of state as $PV = ZRT$ show that $\left(\frac{\partial H}{\partial P}\right)_T = \left\{\frac{-RT}{P}\right\} \left(\frac{\partial Z}{\partial T}\right)_P$.
- 6 Assuming the validity of Raoult's law, prepare a P-x-y for 80°C and a t-x-y for 80 KPa for chlorobutane (1) = chlorobenzene (2) system Antoine parameters are as follows
 $\log_{10} P = A - B/(t + c)$ where P is in Torr and t is in °C.
Chlorobutane: A = 13.96 B = 28866.26 C = 224.10
Chlorobenzene: A = 13.993 B = 3295.12 C = 217.55
- 7 Explain the following terms:
(a) Henry's law.
(b) Lewis/Randall rule.
(c) Excess property.
(d) Residual propriety.
(e) Fugacity.
(f) Activity.
(g) Activity coefficient.
(h) Fugacity coefficient.
- 8 (a) Write the effect of temperature and pressure on equilibrium constant.
(b) Explain the homogeneous chemical reactions.