Code: 9A23404 **R09**

B.Tech II Year II Semester (R09) Supplementary Examinations May/June 2017

THERMODYNAMICS IN BIOPROCESS SYSTEMS

(Biotechnology)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Differentiate between closed system and isolated system giving proper explanations.

(b) What is the significance of joules experiment in the formulation of the first law of thermodynamics?

2 A kilogram of water at 273 K is brought into contact with a heat reservoir at 373 K. When the liquid water has reached 373 K, what is the entropy change of the water and that of the reservoir? What is ΔS_{total}?

3 (a) Show that chemical potential of component in all phases are equal at equilibrium.

(b) Explain briefly estimation procedure for partial property from solution property.

4 Define and explain the terms: Molar Gibbs energy, standard state Gibbs energy, partial Gibbs energy, excess Gibbs energy and residual Gibbs energy. Bring out the differences amongst them with simple thermodynamic relations.

5 (a) Draw and explain Mollier diagram, PH diagram, Ts diagram.

(b) A particular thermodynamic system has the following fundamental relation U = CS2/VN, where C is a constant. Transform the given fundamental relation into the enthalpy representation.

6 Describe about SLE and VLLE with neat diagrams.

7 (a) Define chemical potential of a component in the mixture. Discuss the importance of chemical potential.

(b) Define partial molar property, Mi of a species in solution. Show that the chemical potential and partial molar Gibbs energy are identical.

8 Rate and equilibrium conversion of a chemical reaction depends on what parameters. How rate and equilibrium conversion varies in various situations? Give a suitable example to explain above.

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