Code No: R050212302 **Set No. 1**

II B.Tech I Semester Regular Examinations, November 2006
BIO CHEMICAL THERMODYNAMICS
(Bio-Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define second law of thermodynamics. List alternative statements
   (b) Discuss how limitation of first law disappear in second law of thermodynamics. [16]

2. (a) What is non ideal gas? How it is different from ideal gas? Compare PV data for ideal and non ideal gas.
   (b) Define generalized compressibility factorZ [10+6]

3. Prove any two Maxwell relations from first principle. [16]

4. (a) Discuss the importance of fugacity in thermodynamics.
   (b) Discuss fugacity and fugacity coefficient for pure species. [16]

5. Show that when $x_i \rightarrow 1$Henrys law is valid for one speciess in a binary solution, the Lewis Randall rule is valid for the other one. [16]

6. Consider a system in which the following reaction occur,
   $CH_4 + H_2O \rightarrow CO + 3H_2$ (1)
   $CH_4 + 2H_2O \rightarrow CO_2 + 4H_2$ (2)
   where the numbers (1) and (2) indicate the value of is the reaction index if there are present initially 2 mol CH_4 and 3 mol H_2O determine expressions for the yi as functions of $\in_1 \ and \ \in_2$. (16)

7. Discuss in detail of different metabolic routes to secondary metabolites. [16]

8. Write Short notes
   (a) Yield Coefficients
   (b) Energy source dissimilation [16]

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Code No: R050212302 **Set No. 2**

II B.Tech I Semester Regular Examinations, November 2006
BIO CHEMICAL THERMODYNAMICS
(Bio-Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A steel casting $\left[C_P = 0.5KJ\,K_g^{-1}K^{-1}\right]$ weighing 40Kg and at a temperature of 450^0C is quenched in 150Kg of oil $\left[C_P = 2.5KJ\,K_g^{-1}K^{-1}\right]$ $at\,25^oC$. If there are no heat losses, what is the change in entropy of
   (a) the casting
   (b) the oil and
   (c) both considered together? [16]

2. (a) What is ideal gas? Name the two-basic assumptions, which were made use of in deriving the ideal gas equation of state from kinetic theory arguments.
   (b) Define thermodynamic properties, Classify the thermodynamic properties. What is the use of such classification. [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. (a) Discuss the importance of fugacity in thermodynamics.
   (b) Discuss fugacity and fugacity coefficient for pure species. [16]

5. Discuss and compare Mar gules, Van Laar and Wilson. equations in brief for treating VLE Data. [16]

6. (a) What is Le chatteliers principle? Give suitable examples to explain above principle.
   (b) Discuss the effect of insert gas addition on conversion for various situations. [8+8]

7. (a) Explain the Gaden classification from stoichiometric point of view the product formation in fermentation processes.
   (b) The following stoichiometric equation describes penicillin systhesis: 1.5 Glucose + $H_2SO_4 + 2NH_3 + phenylacetatePencilliumG + CO_2 + 8H2_O$ the theoretical yield of pencillium is 1.2g (gram of glucose). Find out the molecular weight of pencillium G. [16]

8. Discuss in detail the Energy Source dissimilation. [16]

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Code No: R050212302 **Set No. 3**

II B.Tech I Semester Regular Examinations, November 2006
BIO CHEMICAL THERMODYNAMICS
(Bio-Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define any two of the following:-
   i. Energy
   ii. Property
   iii. Work
   iv. Equilibrium
   (b) Differentiate between intensive and extensive properties with suitable examples.
   - [8+8]
2. Name the methods by which the thermodynamic properties of fluids are usually presented. Discuss any two of them [16]
3. A particular thermodynamic system has the following the equations of state. $\frac{1}{T} = \frac{5NR}{2U}; \frac{P}{T} = \frac{NR}{V}$ obtain the third equation of state of the system. [16]
4. (a) Define chemical potential of a component in the mixture. Discuss the importance of chemical potential.
   (b) Define partial molar property $\underset{i}{\bar{M}}$ of species in solution. Show that chemical potential and partial molar Gibbs energy are identical. [16]
5. Prove the following.
   (a) $f_i^{\ell} = f_i^{sat} = \phi_i^{sat} P_i^{sat}$
   (b) $f_i = \phi_i^{sat} P_i^{sat} \exp \frac{V_i^{\ell}\left(P - P^{sat}\right)}{R.T}$ [8+8]
6. Consider a system in which the following reaction occur,
   $CH_4 + H_2O \rightarrow CO + 3H_2$ (1)
   $CH_4 + 2H_2O \rightarrow CO_2 + 4H_2$ (2)
   where the numbers (1) and (2) indicate the value of is the reaction index if there are present initially 2 mol CH_4 and 3 mol H_2O determine expressions for the yi as functions of $\in_1$ *and* $\in_2$. (16)
7. Explain the relation between EMP pathway and Respiratory chain. [16]
8. Discuss in detail that electrons in the organic substrate is transferred to oxygen. [16]

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Code No: R050212302 **Set No. 4**

II B.Tech I Semester Regular Examinations, November 2006
BIO CHEMICAL THERMODYNAMICS
(Bio-Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A reversible engine operating between a reservoir at 600K and the ambient atmosphere at 300K drives a refrigerator operating between 240K and the ambient atmosphere. Determine the ratio of energy rejected by both the devices to the ambient atmosphere to the energy absorbed by the engine from the reservoir at 600K. [16]

2. Write short notes on any two of the following:-
   (a) Redlich Kwong (RK) equation of state
   (b) Virial equation of state
   (c) The compressibility factor method. [16]

3. (a) What is the significance of the second law efficiency?
   (b) Define the second law efficiency of a process. [16]

4. Prove the following.
   (a) $\bar{V}_i^{id} = V_i$ (4)
   (b) $\bar{H}_i^{id} = H_i$ (4)
   (c) $V^{id} = \sum_i x_i V_i$ (4)
   (d) $H^{id} = \sum_i x_i H_i$ (4)

5. Show that when $x_i \rightarrow 1$Henrys law is valid for one speciess in a binary solution, the Lewis Randall rule is valid for the other one. [16]

6. In a particular reactor, which is maintained at 0.1MPa and 1000K, a stoichiometric mixture of CO and H_2O is fed to carry out the water gas shift reaction. Determine the degree of conversion and the composition of the equilibrium mixture, if the equilibrium constant is 2.111. [16]

7. Explain in detail how EMP pathway can be used in five different pathways. [16]

8. Discuss the heat balance in substrate consumption. [16]

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