Code No: 07A30602 **R07** **Set No. 2**

II B.Tech I Semester Examinations,MAY 2011
METALLURGICAL THERMODYNAMICS AND KINETICS
Metallurgy And Material Technology

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain carburizing and decarburizing process with special reference to diffusion. Give their concentration profile?
   (b) Assume that the surface concentration to be constant having 1-2% carbon, calculate the time required to carburize a steel component having original composition of 0.4% carbon to 0.9% carbon at a depth of 0.15mm at 1000 ^{0}C? [8+8]

2. (a) The vapour pressure of liquid iron is given by the equation
   $\log P_{Fe} = \frac{-19,710}{T}$ - 1.27 logT + 13.27.
   Calculate the standard heat of vaporization at 1600 ^{0}C.
   (b) Distinguish between:
      i. Invariant
      ii. Bivariant
      iii. Monovariant
      iv. Trivariant systems with examples. [8+8]

3. (a) What is a heat engine cycle? Explain.
   (b) Explain a heat engine cycle performed by a closed system.
   (c) Calculate the entropy change ΔS^0 which takes place when 1 gm of liquid water and 1 gm of liquid water at 100^0 C are mixed. A constant heat capacity of 1 cal/gm 0^0C may be assumed for water from 0^0 to 100 ^{0}C. [4+6+6]

4. (a) What are the necessary conditions required for spontaneous and feasible reactions in terms of free energies? Explain.
   (b) Using Maxwell relation show that TdS = Cv.dT + P.dV. [8+8]

5. (a) The reversible e.m.f between pure Mg and Mg-Zn alloy containing 63.5 atom 10Mg in a fused KCl-LiCl-$MgCl_2$ electrolyte may be represented by
   $E = 16.08\times10^{-3} + 1.02\times10^{-5}T$, where E and T are in V and K respectively. Calculate the activity coefficient and excess partial molar free energy of mixing Mg in the above alloy at 727 ^{0}C?
   (b) Differentiate between partial molal free energy and standard free energy?[8+8]

6. Explain about the effect of concentration on the reaction rate:
   (a) First order reaction
   (b) Second order reaction

(c) Third order or higher order reaction. [5+5+6]

7. (a) Explain how the slope of the line and entropy change can be calculated from Ellingham diagrams?

   (b) Explain the range of stability of the metallic oxide can be determined from Ellingham diagrams?

   (c) Explain about the possibilities of the oxide and sulphide reactions occur in Extraction processes? [6+5+5]

8. (a) Explain mechanical, thermal and chemical irreversibilities with examples.

   (b) What are the basic equations of state for one mole of ideal and real gas? Explain. [9+7]

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Code No: 07A30602 **R07** **Set No. 4**

II B.Tech I Semester Examinations,MAY 2011
METALLURGICAL THERMODYNAMICS AND KINETICS
Metallurgy And Material Technology

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain mechanical, thermal and chemical irreversibilities with examples.
   (b) What are the basic equations of state for one mole of ideal and real gas? Explain. [9+7]

2. (a) Explain how the slope of the line and entropy change can be calculated from Ellingham diagrams?
   (b) Explain the range of stability of the metallic oxide can be determined from Ellingham diagrams?
   (c) Explain about the possibilities of the oxide and sulphide reactions occur in Extraction processes? [6+5+5]

3. (a) The vapour pressure of liquid iron is given by the equation
   $\log P_{Fe} = \frac{-19,710}{T}$ - 1.27 logT + 13.27.
   Calculate the standard heat of vaporization at 1600 ^{0}C.
   (b) Distinguish between:
      i. Invariant
      ii. Bivariant
      iii. Monovariant
      iv. Trivariant systems with examples. [8+8]

4. (a) What are the necessary conditions required for spontaneous and feasible reactions in terms of free energies? Explain.
   (b) Using Maxwell relation show that TdS = Cv.dT + P.dV. [8+8]

5. (a) What is a heat engine cycle? Explain.
   (b) Explain a heat engine cycle performed by a closed system.
   (c) Calculate the entropy change ΔS^0 which takes place when 1 gm of liquid water and 1 gm of liquid water at 100^0 C are mixed. A constant heat capacity of 1 cal/gm 0^0C may be assumed for water from 0^0 to 100 ^{0}C. [4+6+6]

6. Explain about the effect of concentration on the reaction rate:
   (a) First order reaction
   (b) Second order reaction
   (c) Third order or higher order reaction. [5+5+6]

7. (a) The reversible e.m.f between pure Mg and Mg-Zn alloy containing 63.5 atom 10Mg in a fused KCl-LiCl-$MgCl_2$ electrolyte may be represented by $E = 16.08\times10^{-3} + 1.02\times10^{-5}T$, where E and T are in V and K respectively. Calculate the activity coefficient and excess partial molar free energy of mixing Mg in the above alloy at 727 ^{0}C?

   (b) Differentiate between partial molal free energy and standard free energy?[8+8]

8. (a) Explain carburizing and decarburizing process with special reference to diffusion. Give their concentration profile?

   (b) Assume that the surface concentration to be constant having 1-2% carbon, calculate the time required to carburize a steel component having original composition of 0.4% carbon to 0.9% carbon at a depth of 0.15mm at 1000 ^{0}C? [8+8]

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Code No: 07A30602 **R07** **Set No. 1**

II B.Tech I Semester Examinations,MAY 2011
METALLURGICAL THERMODYNAMICS AND KINETICS
Metallurgy And Material Technology

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

Answer any FIVE Questions
All Questions carry equal marks

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   (b) Distinguish between:
      i. Invariant
      ii. Bivariant
      iii. Monovariant
      iv. Trivariant systems with examples. [8+8]

2. (a) What are the necessary conditions required for spontaneous and feasible reactions in terms of free energies? Explain.
   (b) Using Maxwell relation show that TdS = Cv.dT + P.dV. [8+8]

3. (a) Explain carburizing and decarburizing process with special reference to diffusion. Give their concentration profile?
   (b) Assume that the surface concentration to be constant having 1-2% carbon, calculate the time required to carburize a steel component having original composition of 0.4% carbon to 0.9% carbon at a depth of 0.15mm at 1000 ^{0}C? [8+8]

4. (a) What is a heat engine cycle? Explain.
   (b) Explain a heat engine cycle performed by a closed system.
   (c) Calculate the entropy change ΔS^0 which takes place when 1 gm of liquid water and 1 gm of liquid water at 100^0 C are mixed. A constant heat capacity of 1 cal/gm 0^0C may be assumed for water from 0^0 to 100 ^{0}C. [4+6+6]

5. (a) Explain how the slope of the line and entropy change can be calculated from Ellingham diagrams?
   (b) Explain the range of stability of the metallic oxide can be determined from Ellingham diagrams?
   (c) Explain about the possibilities of the oxide and sulphide reactions occur in Extraction processes? [6+5+5]

6. Explain about the effect of concentration on the reaction rate:
   (a) First order reaction

(b) Second order reaction

(c) Third order or higher order reaction. [5+5+6]

7. (a) Explain mechanical, thermal and chemical irreversibilities with examples.

(b) What are the basic equations of state for one mole of ideal and real gas? Explain. [9+7]

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(b) Differentiate between partial molal free energy and standard free energy?[8+8]

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Code No: 07A30602 **R07** **Set No. 3**

II B.Tech I Semester Examinations,MAY 2011
METALLURGICAL THERMODYNAMICS AND KINETICS
Metallurgy And Material Technology

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

Answer any FIVE Questions
All Questions carry equal marks

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   (b) Differentiate between partial molal free energy and standard free energy?[8+8]

2. (a) What is a heat engine cycle? Explain.
   (b) Explain a heat engine cycle performed by a closed system.
   (c) Calculate the entropy change ΔS^0 which takes place when 1 gm of liquid water and 1 gm of liquid water at 100^0 C are mixed. A constant heat capacity of 1 cal/gm 0^0C may be assumed for water from 0^0 to 100 ^{0}C. [4+6+6]

3. (a) The vapour pressure of liquid iron is given by the equation $\log P_{Fe} = \frac{-19,710}{T}$ - 1.27 logT + 13.27.
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   (b) Distinguish between:
      i. Invariant
      ii. Bivariant
      iii. Monovariant
      iv. Trivariant systems with examples. [8+8]

4. (a) Explain mechanical, thermal and chemical irreversibilities with examples.
   (b) What are the basic equations of state for one mole of ideal and real gas? Explain. [9+7]

5. (a) What are the necessary conditions required for spontaneous and feasible reactions in terms of free energies? Explain.
   (b) Using Maxwell relation show that TdS = Cv.dT + P.dV. [8+8]

6. Explain about the effect of concentration on the reaction rate:
   (a) First order reaction
   (b) Second order reaction
   (c) Third order or higher order reaction. [5+5+6]

7. (a) Explain carburizing and decarburizing process with special reference to diffusion. Give their concentration profile?

   (b) Assume that the surface concentration to be constant having 1-2% carbon, calculate the time required to carburize a steel component having original composition of 0.4% carbon to 0.9% carbon at a depth of 0.15mm at 1000 ^{0}C? [8+8]

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   (b) Explain the range of stability of the metallic oxide can be determined from Ellingham diagrams?

   (c) Explain about the possibilities of the oxide and sulphide reactions occur in Extraction processes? [6+5+5]

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