Code No: R050211802 **Set No.1**

II B.Tech. I Semester Regular Examinations, November -2006
THERMODYNAMICS AND KINETICS
(Metallurgy & Material Technology)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Compare and contrast extensive properties and intensive properties with suitable examples. [6]
   (b) What are the different types of systems? Explain with examples. [5]
   (c) What are path and state functions? Discuss with examples the criteria for finding whether a given function is a path or state function. [5]
2. (a) Derive Kirchoff's equation. [6]
   (b) Distinguish between steady flow and unsteady flow. [5]
   (c) Explain the significance of Joule -Thomson coefficient. [5]
3. (a) Derive a relation to estimate thermal efficiency of a carnot heat engine which employs an ideal gas as its working medium. [6]
   (b) Discuss the entropy and disorder on an atomic scale. [4]
   (c) State and explain the second law of thermodynamics according to Kelvin and Clausius. [6]
4. (a) Write the Boltzman equation and explain the terms in it. [5]
   (b) What is entropy generation? Can the entropy generation be negative? Explain. [5]
   (c) 'According to statistical thermodynamics each macrostate consists of a very large number of quantum states'. Explain. [6]
5. (a) Discuss the importance of sigma function in evaluation of fugacity. [5]
   (b) What are the important deduction of third law of thermodynamics? Explain. [5]
   (c) Explain various methods for the calculation of ΔS^0 for a chemical reaction. [6]
6. (a) What is the relation between free energy and equilibrium constant for any reaction? Explain. [5]
   (b) Explain the tabular method of recording thermodynamic data. [4]
   (c) Calculate the equilibrium constant for the following reaction at 298K; using the following data. [7]
   $\Delta H^0 = -74.85 \times 10^3 J/mole$

$\Delta S^0 = -80.25 J/mole/K$
$C\,(graphite) + 2H_2\,(g) \rightarrow CH_4\,(g)$
(Assume any data if missing)

7. (a) Derive Claussius - Claeyron equation starting from fundamentals. State the conditions under which approximation is valid. [6]
   (b) Explain the steps involved in the determination of order of a reaction. [6]
   (c) Explain zero order reaction. [4]

8. Write short notes on the following [4*4=16]
   (a) Entropy criteria for spontaneous processes
   (b) Estimation of standard free energy charge, ΔG^0.
   (c) Enthalpy and estimation of enthalpy.
   (d) HESS's law.

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Code No: R050211802 **Set No.2**

II B.Tech. I Semester Regular Examinations, November -2006
THERMODYNAMICS AND KINETICS
(Metallurgy & Material Technology)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Discuss the importance of functions of state in thermodynamics. [6]
   (b) Bring out the differences among the following:
      i. Thermodynamics system
      ii. Thermodynamic process and
      iii. Thermodynamic cycle [6]
   (c) What is Quasi equillibrium process? Explain it's importance in engineering. [4]

2. (a) Define and explain first law of thermodynamics. Also discuss the limitations of first law of thermodynamics. [6]
   (b) Derive an expression for work done in a process in which PV = Constant. [6]
   (c) Explain the conclusions that are drawn from Joule - Thomson experiment. [4]

3. (a) What is entropy? What are the different types of entropies? Explain. Give the entropy criterion for spontaneity of a process. [7]
   (b) What is Carnot's theorm? Explain this with the help of a suitable sketch. [5]
   (c) Show that heat flow from higher to lancer temperature increases entropy. [4]

4. (a) 'The entropy is a nonconserved property'. Explain satisfactorily with suitable examples. [5]
   (b) Differentiate between microstate, macrostate and most probable macrostate. [6]
   (c) Write a short note on Maxwell-Boltzman distribution function. [5]

5. (a) Discuss the use of third law of thermodynamics in evaluation of ΔS^0 of a reacion. [6]
   (b) Explain the terms fugacity and activity. Discuss the dependence of pressure and temperature on fugacity and activity. [6]
   (c) Explain the term 'vapour pressure' of an element. [4]

6. (a) Derive an expression to show variation of equilibrium constant with temperature. [6]
   (b) Determine the equilibrium constant at 25^0 C for the following reactions with the given data.
   (Assume any missing data suitably)

$CH_4(g) + H_2o\,(l) \rightarrow CO(g) + 3H_2\,(g)$

Data given

Component	ΔG^0 *at* 25^0C	
$Co(g)$	-32.81	$Kcal/gm/mole$
$CH_4\,(g)$	-12.14	
$H_20(l)$	-56.7	

[7]

(c) Explain sigma function. [3]

7. (a) Explain the practical importance of Claussius-Clapeyron equation. [5]

(b) List the assumptions made in deriving the integrated form of the Claussius - Clapeyron equation. [5]

(c) Derive Claussius - Clapeyron equations from Maxwell's relations. [6]

8. Write short notes on the following:s [4*4=16]

(a) Gibb's - Helmholtz equation

(b) Sigma function

(c) Thermal entropy and configurational entropy

(d) Collision theory in chemical reactions.

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Code No: R050211802 **Set No.3**

II B.Tech. I Semester Regular Examinations, November -2006
THERMODYNAMICS AND KINETICS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Distinguish celarly between temperature, heat and internal energy.
   (b) Explain how Zeroth law is helpful in temperature measurement.
   (c) What are excess thermodynamic properties? Explain them with examples. [6+5+6]
2. (a) Show that the internal energy is a state property.
   (b) What is HESS's Law? Explain its applications in thermodynamics with suitable examples. What are its limitations?
   (c) Distinguish fully between 'Enthalpy' and heat capacity. [4+7+5]
3. (a) State and explain second law of thermodynamics.
   (b) Define and explain entropy. What are its units.
   (c) Derive the expression for the efficiency of Carnot cycle. [6+4+6]
4. (a) What are the causes for the deviation from the perfect order in a solid material? Explain them fully.
   (b) From the fundamentals derive the Gibb's-Helmholtz equation.
   (c) What do you mean by maximum work function? Explain the significance of the same. [5+7+4]
5. (a) What do you understand by the term ' free energy' of a system? What is its significance?
   (b) Why Gibb's free energy is called a thermodynamic potential? Explain.
   (c) State and explain third law of thermodynamics. What is it's impotance? Explain. [4+5+7]
6. (a) Define and explain the following terms.
      i. Fugacity
      ii. Activity
      iii. Equilibrium constant
   (b) What is meant by 'standard free energy change' of a reaction? Derive an expression relating it to the equilibrium constant of the reaction.
   (c) Discuss the dependence of pressure and temperature on fugacity and activity. [6+6+4]

7. (a) Derive the Classius - Clapeyron equation for liquid-vapour equillibrium .
   (b) Compare and contrast molecularity and reaction order.
   (c) Bring out the important characteristics of a catalyst and explain its action. [6+5+5]

8. Write short notes on the following: [4×4=16]
   (a) Theory of absolute reaction rates
   (b) Isobaric and Adiabatic processes
   (c) Chemical potential and variation with temperature
   (d) Joule - Thomson coefficient

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Code No: R050211802 **Set No.4**

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THERMODYNAMICS AND KINETICS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) State and explain Zeroth law of thermodynamics.
   (b) Distinguish between steady state and equilibrium.
   (c) Explain the differences between the classical and statistical approaches to thermodyamics. [5+6+5]

2. (a) State the first law of thermodynamics and show how it defines internal energy as a property.
   (b) Explain the usefulness of Kirchoff's equation in thermodynamics.
   (c) What are point and path functions? Explain them. Give some examples for each of them. [6+4+6]

3. (a) Derive an expression for the efficiency of a cyclic process using Carnot cycle.
   (b) A carnot engine cannot be realised in actual practice. Explain why?
   (c) What are the different mechanisms that can cause entropy of a control volume to change? Explain. [6+5+5]

4. (a) What is entropy density? Explain its significance.
   (b) Write short notes on Maxwell-Boltzmann distribution function.
   (c) Explain how is the most probabale macrostate determined within a given system. [4+6+6]

5. (a) State and explain third law of thermodynamics. Explain how it rationalises the thermochemical data.
   (b) What do you know about fugacity. Deduce activity coefficient from it.
   (c) Give the equations which may be regarded as alternative definitions of the 'Activity'. Explain them in detail. [6+5+5]

6. (a) What do you meean by thermodynamic equilibrium constant? Explain.
   (b) Give the mathematical expressions for fugacity for an ideal gas and non-ideal gas and explain the terms involved in the expression.
   (c) Write the equilibrium constant for the following reactions and explain.
      i. A+B=C+D
      ii. xA+YB+.....=m.C+n.D..... [4+6+6]

7. (a) Derive the following differential form of Claussius - Clapeyron equation.
$\frac{d \ln p^0}{dT} = \frac{\Delta H^0}{R_{T^2}}$
   (b) Explain the various factors affecting rate of a reaction.
   (c) Distinguish between homogeneous catalyst and heterogeneous catalyst. Give examples for each of them. [7+5+4]

8. Write short notes on the following: $[4 \times 4 = 16]$
   (a) Collision theory of chemical reactions
   (b) ideal gas equation
   (c) half life period
   (d) thermodynamic temperature scales.

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