

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III (NEW) EXAMINATION – WINTER 2021****Subject Code:3132105****Date:21-02-2022****Subject Name:Materials Thermodynamics****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		<b>MARKS</b>
<b>Q.1</b>	(a) Explain the importance of studying materials thermodynamics.	<b>03</b>
	(b) What is a system? Explain different kinds of systems in thermodynamics.	<b>04</b>
	(c) What is free energy? Derive equation for Gibb's free energy.	<b>07</b>
<b>Q.2</b>	(a) Explain first law of thermodynamics in terms of enthalpy.	<b>03</b>
	(b) Compare and contrast extensive and intensive properties.	<b>04</b>
	(c) State Gibbs' phase rule for unary and binary systems. Explain the importance of the same from validation perspective.	<b>07</b>
<b>OR</b>		
	(c) Define and explain the terms specific heat at constant pressure (Cp) and specific heat at constant volume (Cv) and derive the thermodynamic relationship between them.	<b>07</b>
<b>Q.3</b>	(a) State zeroth law of thermodynamics and give its importance.	<b>03</b>
	(b) Explain temperature composition diagram for binary eutectic alloy system.	<b>04</b>
	(c) State Hess' law. Give example and explain the salient features of the same.	<b>07</b>
<b>OR</b>		
<b>Q.3</b>	(a) State the significance of entropy in thermodynamics.	<b>03</b>
	(b) Explain temperature composition diagram for binary isomorphous alloy system.	<b>04</b>
	(c) Explain Raoult's law and Henry's law.	<b>07</b>
<b>Q.4</b>	(a) Explain reversible and irreversible processes.	<b>03</b>
	(b) What is chemical potential? Explain the significance of the same.	<b>04</b>
	(c) Derive combined equation of first and second law of thermodynamics in terms of internal energy, enthalpy and free energy.	<b>07</b>
<b>OR</b>		
<b>Q.4</b>	(a) What is equilibrium? Explain different type of equilibrium.	<b>03</b>
	(b) Explain the concept of fugacity and activity.	<b>04</b>
	(c) Derive Maxwell's relations and state third law of thermodynamics.	<b>07</b>
<b>Q.5</b>	(a) Define: 1) Liquidus line, 2) Solidus line, and 3) Solvus line.	<b>03</b>
	(b) Derive Gibb's- Duhem equations.	<b>04</b>
	(c) State & explain Ellingham diagram for various metal oxides.	<b>07</b>

**OR**

- Q.5**
- (a) Define: 1) Phase, 2) Component, and 3) Degree of Freedom. **03**
  - (b) Explain the importance of C – CO & C – CO<sub>2</sub> line in the Ellingham diagram. **04**
  - (c) Explain thermodynamic solution and differentiate between ideal and non ideal solutions. **07**

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