

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III (NEW) EXAMINATION – WINTER 2023

Subject Code:3132105

Date:18-01-2024

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.

	MARK
<b>Q.1</b> (a) Enumerate the main applications of Materials thermodynamics.	<b>03</b>
(b) Explain homogeneous and heterogeneous system.	<b>04</b>
(c) Explain reversible and irreversible changes.	<b>07</b>
<b>Q.2</b> (a) Explain specific heat.	<b>03</b>
(b) Explain different equilibrium systems.	<b>04</b>
(c) Explain 1 <sup>st</sup> law thermodynamics with its significances.	<b>07</b>
<b>OR</b>	
(c) Explain specific heat and prove that $C_p > C_v$ .	<b>07</b>
<b>Q.3</b> (a) Explain latent heat.	<b>03</b>
(b) Justify-Entropy is a state property.	<b>04</b>
(c) Explain 2 <sup>nd</sup> law of thermodynamics with respect to irreversible change.	<b>07</b>
<b>OR</b>	
<b>Q.3</b> (a) Explain work.	<b>03</b>
(b) Explain Roul't's law of solutions.	<b>04</b>
(c) Explain Hess's law of thermodynamics.	<b>07</b>
<b>Q.4</b> (a) State zeroth law of thermodynamics.	<b>03</b>
(b) Explain Sievert's law of solutions.	<b>04</b>
(c) Explain Kirchhoff's law of thermodynamics.	<b>07</b>
<b>OR</b>	
<b>Q.4</b> (a) Explain $F=0$ , $F=1$ and $F=2$ conditions with respect to Gibb's phase rule.	<b>03</b>
(b) A brass contain 70 wt. % of Copper and rest of Zinc. Calculate atom %. Atomic weights of Cu and Zn are 63.54 and 65.38.	<b>04</b>
(c) Derive Gibb's phase rule.	<b>07</b>
<b>Q.5</b> (a) Explain 3 <sup>rd</sup> law of themodynamics.	<b>03</b>
(b) For the reaction: $CO_{(g)} + 1/2O_{2(g)} = CO_{2(g)}$ . Calculate the standard enthalpy change for the above reaction at 500 K, given that the standard enthalpy change of formation at 298 K are -110.5 kJ/mol for $CO_{(g)}$ and -393.5 kJ/mol for $CO_{2(g)}$ . Molar heat capacities ( $C_p$ ) are as follows: For $CO_{(g)} = 30.0 + 0.0041 T$ J/K.mol, $O_{2(g)} = 28.5 + 0.0042 T$ J/K.mol, $CO_{2(g)} = 44.2 + 0.0088 T$ J/K.mol.	<b>04</b>
(c) Discuss important features of Ellingham diagram.	<b>07</b>

**OR**

- Q.5** (a) Justify-Energy is the state property. **03**
- (b) Calculate change of free energy for the following reduction reaction at 500 K. **04**  
 $\text{CuO (s)} + \text{H}_2 \text{(g)} = \text{Cu (s)} + \text{H}_2 \text{(g)}$ . Given  $\Delta H^\circ_{500} = 88 \text{ kJ/mol}$  and  $\Delta S^\circ_{500} = 88 \text{ kJ/mol}$ .
- (c) Derive Gibb's Duhem equation. **07**

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