GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3132105
Semester – III
Subject Name: Materials Thermodynamics

Type of course: Professional Core Course.

Prerequisite: Basic concepts regarding thermodynamics & Zeal to learn the subject.

Rationale: Materials Thermodynamics is design oriented subject and application in Materials Processes. To highlight the fundamental role of Thermodynamics in describing metallurgical and materials processes. To learn and use thermodynamic functions, rules and relations and interpret thermodynamic plots and diagrams.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
2	2	0	4	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction: thermodynamic terms, Ideal Gas, Energy and Work, Extensive and Intensive Properties, Zeroth law of thermodynamics	**2**
2	First Law of Thermodynamics, Internal Energy, Enthalpy, Heat Capacity, Reversible Processes	**3**
3	Second Law of Thermodynamics, Entropy and equilibrium, Reversibility, Heat Engines, Statistical Interpretation of Entropy, Boltzmann Equation, Auxiliary Functions Enthalpy, Free Energy, Chemical Potential, Maxwell's Equations, Gibbs-Helmholtz Equation	**9**
4	Enthalpy as a Function of Temperature and Composition, Third Law of Thermodynamics, Phase Equilibrium in a One-Component System, Equilibrium between Vapor and Condensed Phase, and between condensed phases, Raoult's Law and Henry's Law, Activity, Gibbs-Duhem Equation, Properties of Ideal and Non-ideal Solutions, Regular Solutions	**10**
5	Ellingham Diagrams, The Gibbs Phase Rule, Phase Diagrams of some Binary Systems	**4**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**30**	**50**	**5**	**0**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Introduction to Thermodynamics of Materials, 5th Edition, David R Gaskell, Taylor & Francis, 2016.
2. Materials Thermodynamics with Emphasis on Chemical Approach, Hae-Geon Lee, World
3. Thermodynamics in Materials Science, Robert DeHoff, CRC Press, 2006.
4. Metallurgical Thermodynamics, Kinetics and Numericals, S.K.Dutta and Prof. A.B.Lele
5. Introduction to Materials and Metallurgical Thermodynamics by A. Ghosh published by PHI
6. Problems in Metallurgical Thermodynamics and Kinetics by G. S. Upadhyaya and R. K. Dube published by Pergamon Press

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO 1	Identify different system and thermodynamic processes.	15
CO 2	Apply thermodynamic laws for metallurgical applications.	55
CO 3	Calculate enthalpy and entropy of reaction.	30

List of Open Source Software/learning website:

1. http://nptel.iitm.ac.in
2. http://ocw.mit.edu