



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code: 3730908

Semester – III

Subject Name: Advanced Metallurgy

Type of course: Program Elective

Prerequisite: Zeal to learn the Subject

Rationale: The strong dependence of our society on metals and alloys makes metallurgy an important branch of modern engineering. Metallurgical and materials engineering involves design, innovate and improve the process; to transform minerals and metals to useful products we use every day in our life. It is a discipline that enables both the creation and application of materials in society. Also, Materials engineers develop materials for new applications, improve existing materials to enhance performance and evaluate ways in which different materials can be used together. This course focuses on the fundamental and engineering aspects of conventional metallurgy, materials and advanced materials.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	0	70	30	0	0	100	

Content:

Sr. No.	Content	Total Hrs
1	Aspects of Physical Metallurgy: Crystal structure, systems and Barvias lattices, Indexing of lattice planes (Miller's Indices), Indexing of lattice directions, Co-ordination Number (Ligency), Density calculations and imperfections in crystals	05
2	Phase Diagrams: Study of Equilibrium diagrams for Fe-C systems, Cu - Bronze alloys i.e. Cu:Zn, Cu:Sn, Cu:Al etc., Developments in metallic materials like HSLA state, maraging steels, dual phased steels, creep resisting steels, materials for high and low temperature applications, Nimerics, Inconels, Haste Alloys etc., Al, Ni alloys, Ti, Mg alloys.	12
3	Heat Treatment: Heat Treatment of Nonferrous alloys, Heat Treatment of Tool steels	08
4	Advances in Materials: Orthodontal materials, Bio material, Prosthetic materials, Nano materials, super conducting materials, sports materials, composites, ceramics, cermets, shape memory alloys their manufacturing techniques, advantages and limitations.	12
5	Surface Treatments: Surface coatings and their tribological aspects. PVD, CVD, IVD ion implantation method.	06



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Reference Books:

1. Engineering Metallurgy, R. A. Higgins, Viva Books Pvt. Ltd.
2. Elements of Material Science and Engineering, Lawrence H., Van Vlack Addison Wesley Publishing Company.
3. Principles of Material Science and Engineering, William F. Smith, McGraw-HillBook Co.
4. Material Science and Engineering an Introduction, William D. Callister, Jr., John Wiley and Sons Inc.
5. Smithells Metals Reference Book, E. A. Brandes and G. B. Brook, Butterworth Heinemann.
6. Biomaterials and Bioengineering Handbook, Donald L. Wise, Marcel Dekker Inc.

Course Outcome:

After learning the course :

Sr. No.	Course Outcome	Percentage weightage
CO-1	Students will be able to demonstrate understanding of various aspects of crystal and lattice structure and their imperfection.	15%
CO-2	Students will be able to understand importance of equilibrium diagrams and their uses in developing materials.	25%
CO-3	Students will be able to the process of heat treatment of different nonferrous alloys and tool steel and decide a heat treatment to acquire their desired properties.	20%
CO-4	Students will be able to demonstrate acquisition of knowledge of composites, ceramics, orthodontal and biomaterials.	25%
CO-5	Students will be able to understand various surface treatments.	15%

List of Open Source Software/learning website:

<https://nptel.ac.in/courses/>