



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3162115
Semester – VI
Subject Name: Advanced Materials

Type of course: Engineering Science

Prerequisite: Knowledge of Basic Metallurgy and common Engineering Materials

Rationale:

Materials have an important role in every field of engineering. The materials we use and how we make them can determine the function, feasibility, cost, environmental impact and many other aspects of things we create. Advanced Materials are the materials used in "High-Tec" applications, usually designed for maximum performance. Examples are titanium alloys for supersonic airplanes, magnetic alloys for computer disks, special ceramics for the heat shield of the space shuttle, etc. Metallurgy engineers design new materials, select the best material for a particular job, monitor its performance and figure out why a material failed and bring expertise on the properties of materials. To do this, Metallurgy engineers need to understand that how materials are made, its structure/composition, how and why materials are useful, what is the limit of materials and how materials can be made better or create a new material that will have some desirable properties. The Advanced Materials course is to prepare students for careers in metallurgy engineering where knowledge of Properties and applications of different Advanced Materials can be applied for the selection of candidate material for a given task. This course will enable students to solve metallurgical problems upon graduation while at the same time, provide a firm foundation for the pursuit of graduate studies in metallurgy engineering.

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)	
2	1	0	3	70	30	0	0	100



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Content:

Sr. No.	Content	Hrs.
1	Special steels Composition, Properties and applications of: Different Stainless steels, Dual phase steels, TRIP steels, Maraging steels, High speed steels, Hadfield steels, Free cutting steels, Ausformed steels, Tool Steels, Bearing steels, spring steels, HSLA steels etc..	07
2	Alloy cast iron Need of alloying. Silal, Nicrosilal, High silicon cast iron, Ni-hard, Heat resistant cast iron: Composition, Properties and their applications.	02
3	Light metals and their alloys Aluminium, magnesium and titanium alloys: Metallurgical aspects, Properties and applications.	02
4	Super alloys Iron base, nickel base and cobalt base super alloys: Strengthening mechanism, Composition, Properties and their applications.	03
5	Rapid Solidification Metallic glasses, Atomic arrangement, Comparison with crystalline alloys, properties & applications, Glass transition temperature, Glass forming ability, Techniques for Production of metallic glasses.	03
6	Nano materials Definition, Types, Properties and applications, Carbon nano tubes, Methods of production.	03
7	Smart materials Shape memory alloys, Piezoelectric materials, Electro-rheological fluid, Magneto-rheological fluids.	03
8	Miscellaneous Advanced Materials Ceramics, Composites, Surface composites, Biomaterials, Aerospace materials, Cryogenic materials, Semi conducting and Superconducting materials.	05
Total		28

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	30	40	10	05	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. The Science and Engineering of Materials by D. R. Askeland and P. P. Phule, Thomson Publication
2. Advances in Material Science by R. K. Dogra and A. K. Sharma



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3. Material science by Van Black.
4. Engineering Materials and Applications by R. A. Flinn and P. K. Trojan
5. Materials, their Nature, Properties and Fabrication by R. A. Lindberg and S. D. Sehgal, S Chand & Co.
6. Light Alloys: Metallurgy of Light Metals by I. J. Polmear
7. Engineering Materials: Properties and applications of Metals and alloys by CP Sharma, PHI
8. Engineering Materials: Polymers, ceramics and composites by AK Bhargava, PHI
9. Nano Technology by AK Bandyopadhyay, New age international publishers

Course Outcomes:

Sr. No.	CO statement	Marks % Weightage
CO-1	Understand properties and application of different advance materials.	60%
CO-2	Suggest modification in materials for a specific property requirement.	15%
CO-3	Apply advance materials for given application requirement.	25%

List of Open Source Software/learning website:

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