

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM  
COURSE TITLE: ADVANCE ENGINEERING MATERIALS  
(COURSE CODE: 3352105)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Metallurgy Engineering	5 <sup>th</sup> Semester

### 1. RATIONALE

Engineers need to be updated with latest materials to meet the challenges of developing cost effective technologies. This course therefore highlights advances in engineering materials including nano materials.

### 2. LIST OF COMPETENCY

The course should be taught and implemented with the aim to develop required skills in students so that they are able to acquire following competency:

- **Select appropriate advanced engineering materials for different engineering applications.**

### 3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Describe metallic and non-metallic materials.
- Explain preparation of high strength materials.
- Suggest materials for low and high temperature applications.
- Integrate knowledge of different types of advanced engineering materials
- Analyse problem and find appropriate solution for use of materials.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
3	2	0	5	70	30	0	0	

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

**5. COURSE CONTENT DETAILS**

<b>Unit</b>	<b>Major Learning Outcomes (in cognitive domain)</b>	<b>Topics and Sub-topics</b>
<b>Unit – I Classification and Selection of Materials</b>	1a. Classify materials. 1b. Select engineering materials for various applications.	1.1 Classification of materials. 1.2 Properties required in Engineering materials. 1.3 Criteria of selection of materials. 1.4 Requirements / needs of advance materials.
<b>Unit – II Non Metallic Materials</b>	1a. Describe different non-metallic engineering materials with respect to properties and applications – Plastics, Ceramics, Optical fibres, Composites. 1b. Explain processes for Rubber	2.1 Classification of non metallic materials. 2.2 Rubber : Properties, processing and applications. 2.3 Plastics : Thermosetting and Thermoplastics, Applications and properties. 2.4 Ceramics : Properties and applications. 2.5 Adhesives: Properties and applications. 2.6 Optical fibers : Properties and applications. 2.7 Composites : Properties and applications.
<b>Unit – III High Strength Materials</b>	3a. Describe methods of strengthening of alloys. 3b. Describe materials available for high strength applications. 3c. Explain the properties and applications of high strength materials.	3.1 Methods of strengthening of alloys. 3.2 Materials available for high strength applications. 3.3 Properties required for high strength materials. 3.4 Applications of high strength materials.
<b>Unit – IV Low &amp; High Temperature Materials</b>	4a. Describe different materials for low and high temperature applications.	4.1 Properties required for low temperature applications. 4.2 Materials available for low temperature applications. 4.3 Requirements of materials for high temperature applications. 4.5 Materials available for high temperature applications. 4.6 Applications of low and high temperature materials.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit – V Nanomaterials</b>	5a. Define nanomaterials 5b. Describe types of nano materials. 5c. Explain physical and mechanical properties and applications of nanomaterials.	5.1 Definition 5.2 Types of nanomaterials including carbon nanotubes and nanocomposites 5.3 Physical and mechanical properties 5.4 Applications of nanomaterials.

## 6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I.	Classification and Selection of Materials	6	4	4	2	10
II.	Non Metallic Materials	12	10	10	5	25
III.	High Strength Materials	8	4	4	2	10
IV.	Low and High Temperature Materials	10	8	4	3	15
V.	Nano materials	6	4	4	2	10
<b>Total</b>		<b>42</b>	<b>30</b>	<b>26</b>	<b>14</b>	<b>70</b>

**Legends:** R = Remember U = Understand; A = Apply and above levels (Bloom's revised 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.

## 7. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

*Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes*

S. No.	Unit No.	Practical/Exercises (outcomes in psychomotor domain)	Approx. Hrs. Required
1	I	Identify the different advance materials.	2
2	I	Demonstrate the properties of the advanced engineering materials.	2
3	II	Demonstrate the use of rubber in two important engineering	4

S. No.	Unit No.	Practical/Exercises (outcomes in psychomotor domain)	Approx. Hrs. Required
		applications.	
4	II	Demonstrate the use of a thermosetting and thermoplastic in engineering components.	4
5	II	Demonstrate the manufacturing method of any two ceramics.	4
6	II	Demonstrate the use of optical fibre for communication.	4
7	II & V	Demonstrate the steps of manufacture of nanocomposite.	4
8	III	Demonstrate the precipitation hardening of Al-4.5 Cu alloy.	4
9	IV	Demonstrate ductile to brittle transition in metals.	4
<b>Total</b>			<b>32</b>

## 8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will explore internet and prepare a report on advance materials and advance technologies being used for making those materials.
- ii. Students will collect samples of advance metal and non metal materials from the market for comparison of their properties and rates.

## 9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Present video/animation film on advance materials and their production processes.
- ii. Seminar by group of students based on report prepared by them by exploring internet.
- iii. Demonstration of samples of advance materials

## 10. SUGGESTED LEARNING RESOURCES

### (A) List of Books:

S. No.	Title of Books	Author	Publication
I.	Elements Of Material Science And Engineering	Van Vlack	Pearson Education India
II.	Material science and Metallurgy	V.D. Kodgire	Everest Publishing House
III.	The Science and Engineering of Materials	D. R. Askeland and P. P. Phule	Thomson Publication
IV.	Physical Metallurgy-II	Gulaev	MIR Publication
V.	Nano Technology	Gregory Tirp	Springer

### B. List of Major Equipment/Materials

Sample of the advance materials and models/charts depicting production processes and applications of advance materials.

### C List of Software/Learning Websites

- i. <http://nptel.iitm.ac.in>
- ii. <http://www.sv.vt.edu>

- iii. <http://www.youtube.com>
- iv. <http://ocw.mit.edu/>
- v. [http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1527-2648;jsessionid=8D9B3C886EAA23FFCAD8DE30EEE82364.f03t04](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1527-2648;jsessionid=8D9B3C886EAA23FFCAD8DE30EEE82364.f03t04)

## **11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**

### **Faculty Members from Polytechnics**

- **Prof. Smt B. H. Goyal**, I/c. Head of Department of Metallurgy, Dr S. and S.S Ghandhy college of Engg. and Technology
- **Dr. G.H Upadhyay**, Professor of Metallurgy, Department of Mechanical Engineering. L.D.College of Engineering, Ahmedabad
- **H. H. Jadav**, Assistant Professor, Metallurgy Department, Government Engineering College, Sector 28, Gandhinagar.

### **Coordinator and Faculty Members from NITTTR Bhopal**

- **Dr. C.K Chugh**, Professor, Department of Mechanical Engineering
- **Prof Shashi Kant Gupta**, Professor and Coordinator for State of Gujarat.