GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

CHEMICAL ENGINEERING MATERIALS
(Code: 3330501)

Diploma Programme in which this course is offered	Semester in which offered
Diploma in Chemical Engineering	3rd Semester

1 RATIONALE

For working in the industries related to chemical manufacturing, students requires the knowledge of various classes of material like metals and alloys, ceramics, polymers, composites, coatings, insulating materials, adhesives and lubricants for different applications. Study of Chemical Engineering Materials also has importance towards the understanding of properties of materials for construction of various equipments and piping systems. Properties of materials affect the life and performance of equipments to the large extent. Thus information of properties of these materials is important for students to ensure the minimum cost of products and safety in the plants.

2 COMPETENCY (Programme Outcome according to NBA Terminology):

The course content should be taught and implemented with the aim to develop different types of skills in the students so that they are able to acquire the following competencies:

- **Identify appropriate materials for chemical plant equipments, piping, insulation and lining.**

3 TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	100
3	2	0	5	70	30	00	00	

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

4 COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit-I **Properties Of Materials**	Describe scope of material science Explain important properties of materials Select materials	1 Scope of material science 2 Definition and explanation of : Melting point, Boiling point, Specific heat, Thermal conductivity, Thermal expansion, Thermal insulation, Stresses, Strain, Yield stress, Fatigue,Creep 3 Principles of selection of materials
Unit-II **Corrosion and Its Prevention**	Define corrosion and describe it's types Control and prevent corrosion	1 Definition of corrosion 2 Types of corrosion: Direct corrosion, Electro-chemical corrosion, Galvanic corrosion, High temperature corrosion 3 Factors affecting corrosion rate 4 Methods for control and prevention of corrosion
Unit– III **Metals and Alloys**	Describe and compare ferrous metals and alloys Describe non-Ferrous metals and alloys Explain furnaces	1 Properties and uses of Cast iron, Wrought iron, Mild steel, Stainless steel 2 Comparison of ferrous metals and alloys 3 Properties and uses of metals: Aluminium, Zinc, Chromium, Nickel, Tin, Copper, Titanium, Tungsten, Platinum and Silver 4 Properties and uses of alloys : Duralumin, Brass, Bronze, Inconel, Hastalloy B and C, Invar,

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
		Y alloy 5 Purification of metals using Blast furnace and Arc furnace
Unit– IV **Ceramic Materials**	Describe ceramic materials Compare ceramic material	Ceramic materials 2 Composition, properties and uses of china clay, fire clay, bentonite 3 Classification, properties and uses of refractories 4 Composition, properties and uses of Soda lime glass, borosilicate glass, high silica glass, fibre glass, glass wool, form glass 5 Composition, properties and uses of Porcelain
Unit-V **Organic Materials**	Describe polymers Compare types of polymerization Describe and classify plastics, rubbers Explain vulcanizing of rubber	Definition and importance of Polymer 2 Addition and condensation Polymerization 3 Plastics : definition, classification, general properties and uses 4 Rubbers : definition, classification, general properties and uses 5 Compare natural and synthetic rubber 6 Vulcanizing of rubber

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit-VI **Protective Coatings and Insulations**	6a. Describe and classify paints 6b. Describe and classify Varnishes 6c. Describe and Classify insulations	Paints: classification and uses Ingredients of paints: their properties and importance Special types of paints and their applications Varnishes: classification and uses Ingredients of Varnishes Types of insulations Properties and applications of different :(i) Electric insulation (ii)Thermal insulation
Unit-VII **Composites, Lubricants and Adhesives**	Describe and classify composites Describe and classify lubricants Describe and classify adhesives	List of composite materials Properties and uses of Fiber reinforced plastics(FRP), Metal matrix composites(MMC), Ceramic matrix composites(CMC) Classification, properties and uses of Synthetic lubricants, Semisolid lubricants Adhesives: classification, properties and uses

5 SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Properties of Materials	4	2	3	2	07
II	Corrosion and its Prevention	6	2	4	4	10
III	Metals and Alloys	7	5	4	3	12
IV	Ceramic Materials	6	4	4	2	10
V	Organic Materials	5	3	3	2	08
VI	Protective coatings and Insulations	6	4	4	2	10
VII	Composites, Lubricants and adhesives	8	4	5	4	13
	Total	**42**	**24**	**27**	**19**	**70**

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.

6 SUGGESTED LIST OF PRACTICAL/EXERCISES

(Not Applicable)

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like: course/topic based presentations, internet based assignments, and teacher guided self learning activities, MCQ/Quiz. These could be individual or group-based.

8. SPECIAL INSTRUCTIONAL STRATEGY (If Any)

1. Collecting and demonstrating samples of different materials
2. Following Tutorials exercises may be given to the students

S. No.	Unit No.	Topic on which Tutorial Exercises may be given	Approx. Hrs. Required
1	I	Principles of selection of materials	04
2	II	Control and prevention of corrosion	04
3	III	Comparison of properties of Ferrous metals and alloys	04
4	III	Comparison of properties of important Non-Ferrous metals and alloys	04

S. No.	Unit No.	Topic on which Tutorial Exercises may be given	Approx. Hrs. Required
5	IV	Comparison of properties of Refractories	04
6	V	Compounding of Plastic and Rubber	02
7	VI	Ingredients of Paints and varnishes	02
8	VI	Thermal insulations	02
9	VII	FRP	02
		Total	**28**

9. SUGGESTED LEARNING RESOURCES

A. List of Books:

S. No.	Title of Books	Author	Publication
1	Material science and processes	Hazarachaudhary S. K.	Indian book distribution co.
2	Engineering Materials	Rangwala S C, Rangwala K. S.	Charotar publishing house pvt. limited
3	Engineering Materials	Rajput R. K.	S.Chand and Co., New Delhi

B. List of Major Equipment/Materials

---- Nil ----

C List of Software/Learning Websites

i. web.iitd.ac.in/~suniljha/MEL120/L2_Engineering_Materials.pdf
ii. http://engineershandbook.com/Materials
iii. www.engineeringtoolbox.com/engineering-materials-properties-d_1225.html
iv. http://nptel.iitm.ac.in/courses.php

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

- **Prof. R. P. Hadiya**, Lecturer in Chemical Engineering, Government Polytechnic, Rajkot
- **Prof. Kajal J. Sareriya**, Lecturer in Chemical Engineering, Government Polytechnic, Rajkot
- **Prof. N. N. Hansalia**, Lecturer in Chemical Engineering, Government Polytechnic, Rajkot
- **Prof. Manish R. Nasit**, Lecturer in Chemical Engineering, Shri N. G. Patel Polytechnic, Isroli - Afwa

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof Bashir Shaikh**, Assistant Professor, Department of Applied Sciences.
- **Prof Shashi Kant Gupta,** Professor and Coordinator for State of Gujarat