



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3172115
Semester – VII
Subject Name: Surface Engineering

Type of course: Engineering/science

Prerequisite: Knowledge of Basics of Material Science and Metallurgy

Rationale: This course on Surface Engineering covers the various techniques of surface modifications for applications such as engineering components, in which the substrate / bulk material properties are the primary consideration and the surface properties must be modified for aesthetics, oxidation resistance, hardness, wear resistance, fatigue resistance or other considerations. This course shall be very helpful to the engineering student to develop essential skill & knowledge of the surface coating technologies in demand.

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	1	0	4	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	Need for engineered surface, definition and principles. Surface Preparation methods such as: Sand Blasting, Shot peening, Shot blasting, Hydro-blasting, Vapor Phase Degreasing. Coatings: Metallic, Ceramic, Rubber, Glass, their introduction and applications.	04
2	Conventional surface hardening methods Carburizing, Nitriding, Carbonitriding, Cyaniding, Chromizing, Boronizing, Boronitriding, Flame hardening and induction hardening: Methodology, mechanisms, important reactions involved, Process parameters and applications.	10
3	Metallic Coatings Galvanizing, Tinning, Electrolytic and Electro less plating: Methodology, mechanisms, important reactions involved, Process parameters and applications. Testing/ evaluation of metallic coatings.	08
4	Chemical conversion coatings Chromating, Phosphating, Anodizing: Methodology used, mechanisms, important reactions involved, Process parameters and applications.	06
5	Application of ion and electron beam, Plasma, laser, Friction stir processing towards creating new engineered surface. Controlled high quality surface modification by techniques: CVD, PVD.	08



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6	Thermal spray coatings: Processes, Types of spray guns, Comparison of typical thermal spray processes, Surface Preparation, Finishing Treatment, Coating Structures and Properties, Applications.	06
	Total	42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	25%	35%	25%	5%	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 Surface Engineering, P. A. Dearnley, Cambridge University Press, 2017
2. J. R. Davis-Surface Engineering for Corrosion and Wear Resistance.
3. George J. Ruzski -Surface Finishing Systems. metal and non-metal finishing handbook-guide, Metals Park : ASM, 1983
4. James A. Murphy- Surface Preparation and Finishes for Metal, McGraw-Hill, New York 1971
5. P. G. Sheasby and R. Pinner - Surface treatment and finishing of Aluminium and its alloy, Volume-2, 5th ed., ASM, Metals Park, 1987
6. Surface Engineering, ASM Handbook, Volume-5, 9TH Edition , ASM International.
7. Friction Stir Welding and Processing, R.S. Mishra and M.W. Mahoney, ASM International, 2007, ISBN: 978-0-87170-840-3.

Course Outcomes

After completing this course, students will able to,

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the need for surface engineering and various methods for engineering requirements.	25
CO-2	Suggest the types of surface engineering methods for a given application	40
CO-3	Analyze the treatment for industrial components through Case-Studies.	35

List of Tutorials:

1. Comparison of various Surface Preparation methods



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2. Case study on Surface modification by conventional surface hardening methods of given industrial component.
3. Case study on Surface modification by Metallic Coatings of given industrial component.
4. Case study on Surface modification by Chemical conversion coatings of given industrial component.
5. Case study on Surface modification by Thermal spray coatings of given industrial component.
6. Case study on Surface modification using ion beam /electron beam/ Plasma of given industrial component.
7. Report writing of Industrial visit/ lab visit/ expert lecture

List of Open Source Software/learning website:

1. <https://nptel.ac.in/courses/112/107/112107248/>
2. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm06/>
3. www.ocw.mit.edu
4. www.corrosion-doctors.org