



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering (Part Time)

Subject Code: 2971911

Semester –VII

Subject Name: Nanotechnology and Surface Engineering

Type of course: Open Elective

Prerequisite: Zeal to learn the subject

## Rationale:

To make students understand the use of concept of nanotechnology and nanoscience in the industries and in consumer products. The surface properties must be modified for aesthetics, oxidation resistance, hardness, wear resistance, fatigue resistance or other considerations. This course will be useful for the 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	0	0	3	70	30	00	0	100

## Content:

Sr. No.	Content	Total Hrs
1	<b>Basic Elements of Nano-science and Nanotechnology:</b> Engineering scale of nanotechnology, different classes of nano-materials, synthesis of nano-materials, fabrication and characterization of nanostructures, Engineering applications- Cosmetics and Consumer Goods, Nano Sensor, Nano catalysts, Water Treatment and the Environment, Paints, Food and Agriculture Industry.	12
2	<b>Nanotechnology and Ceramics :</b> Introduction, Vapor Condensation Methods, Sputtering, Laser Method, Spray Pyrolysis, Thermo Chemical /Flame Decomposition of metal organic Precursors methods	8
3	<b>Tools to characterize Nanomaterials:</b> X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy, UV/Visible Spectroscopy	6
4	<b>Surface Engineering:</b> Introduction to surface engineering, Scope of surface engineering for different engineering materials, Surface Preparation methods such as Chemical, Electrochemical, Mechanical: Sand Blasting, Shot peening, Shot blasting, Hydro-blasting, Vapor Phase Degreasing etc., Coatings: Classification, Properties and applications of Various Coatings.	6
5	<b>Different methods for surface modifications:</b> Surface modification by use of directed energy beams, Plasma, Sputtering & Ion Implantation. Surface modification by Friction stir processing. Surface composites.	10
6	Case studies based on coatings and surface modification of important engineering components.	5



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## Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	40	20	-	-

**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. Nanostructures and Nanomaterials: Synthesis, Properties and Applications by G. Cao, Imperial College Press, 2004.
2. Nanoscale Science and technology by Robert Kelsall (editor), Ian W. Hamley (co-editor), Mark Geoghegan (co-editor) , ISBN: 978-0-470-85086-2
3. The Chemistry of Nanomaterials: Synthesis, Properties and Applications by C. N. R. Rao, A. Muller, A. K. Cheetham, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, ISBN: 3-527-30686-2.
4. Nanoscale Materials in Chemistry Edited by Kenneth J. Klabunde, John Wiley & Sons, Inc., ISBNs: 0-471-38395-3 (Hardback); 0-471-22062-0.
5. Textbook of Nanoscience and Nanotechnology, B.S. Muty, P. Shankar, Baldev Raj, B.B Rath and James Murday, University Press, IIM ( ISBN-978 81 7371 738 3).
6. Introduction to Nanotechnology by Charles P. Poole Jr and. Frank J. Owens, Wiley-Inter science, 2003.
7. James A. Murphy- Surface Preparation and Finishes for Metal, McGraw-Hill, New York 1971
8. Surface Engineering Hand Book, edited by Keith Austin, London : Kogan Page, 1998

## Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To comprehend basics of nano-science and technology and their applications in the domain of engineering.	20
CO-2	To impart fundamental knowledge of various methods used in the field of nano-technology	20
CO-3	To impart basics of various characterization tools/methods in the field of Nano-Technology.	20
CO-4	Explain the effect of process parameters on the properties & microstructure of the surface coating processes.	20
CO-5	Understand the importance & role of surface modifications to achieve several technological properties.	20



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**List of Experiments:**

**Major Equipment:** Electronics Microscope, XRD, UV

**List of Open Source Software/learning website:** <https://nptel.ac.in/course.php>