



C. U. SHAH UNIVERSITY
Wadhwan City

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: - Mechanical Engineering
SEMESTER: - VI
CODE: - 4TE06NAT1
NAME – Nanotechnology

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE06NAT1	Nanotechnology	3	0	0	3	3	30	1.5	70	3	---	---	---	100

Objectives:-

- The objective of this course is to make students familiar with the important concepts in Nanotechnology.

Prerequisites: -

- To understand above subject knowledge of optical physics, inorganic chemistry, crystal structure of materials (Crystal Physics), and electrical and magnetic properties of materials.

Course outline:-

Sr. No.	Course Contents	Hours
1	NANOMATERIALS: Nanoporous Materials – Silicon - Zeolites, mesoporous materials - nanomembranes and carbon nanotubes - AgX photography, smart sunglasses, and transparent conducting oxides –molecular sieves – nanosponges. Nano Ceramics Metal-Oxide or Metal-Ceramic composites. Different aspects of their preparation techniques and their final properties and functionality. Metal based nanocomposites Metal-metal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties.	8
2	PROCESSING OF STRUCTURAL AND FUNCTIONAL NANOCRYSTALLINE MATERIALS: Properties required of nanocrystalline materials used for structural, hydrogen storage, magnetic and catalytic applications; processing techniques; techniques for retaining the nanocrystalline structure in service.	5
3	ADVANCE NANO MATERIALS: Fundamentals of magnetic materials, Dia, Para , Ferro , Antiferro , Ferri, Superpara magnatic materials AND giant and colossal magneto-resistance. Important properties in relation to nanomagnetic materials. Carbon Nano Structures: Introduction; Fullerenes, C60, C80 and C240 Nanostructures; Properties & Applications (mechanical, optical and electrical).	7
4	MEMS: Materials for mems and pro mems-silicon-metals and polymers. microfabrication- Fabrication – design and application . physics of mems –scaling laws heat transfer- mechanics and electrostatics – batch fabrication – circuit integration.	8



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	Fabrication Methods, Nanomaterials Deposition Methods PVD, Photolithography, Materials for Micromachining Substrate ,Additive Films and Materials, Bulk Micro machining ,Wet Etching, Dry Etching ,Surface Micro machining , Fusion Bonding, High-Aspect-Ratio-Micromachining, LIGA, self assembling system, Molecular Manipulation, Laser Micromachining, etc.	
5	COMMERCIAL AND TECHNOLOGICAL TRENDS Commercial trends in miniaturization – High density chip analysis – lab – in – chip for DNA and protein analysis – Nano HPCL system. Nanodesign Nano-CAD: Modeling of Nanodvices. Applications and examples problems based on Molecular dynamics simulations.	7
6	Applications of nanomaterials: In the areas of electronics, photonics, biology, health and environment, medicine, defence, chemicals, catalysts, textiles, etc. Application of nanotechnology in remediation of pollution, photocatalysis and other nanocatalysts, greenhouse gases, global warming. Monitoring nanoparticles at work place and sensors used for this.	10

Learning Outcomes:-

- Get knowledge of Nanotechnology
- Understand difference between properties Nanomaterial and conversional materials
- Understand the application of Nanomaterials
- Understand the mean of Nanoelectronics
- Understand the optical properties of Nanomaterials.

Books Recommended:-

Text Books:-

1. Nanotechnology - Basic Science and Emerging Technologies **Mick Wilson, Kamali Kannangra Geoff Smith, Michelle Simons and Burkhard Raguse**, Overseas Press.
2. Nanotechnology – A Gentle Introduction to the Next Big Idea **Mark Ratner and Daniel Ratner**, Prentice Hall

Reference Book:

1. Nanotechnology: **Rebecca L Johnson**, Lerner Publications.
2. Introduction to Nanotechnology: **Charles P. Poole Jr.**, Chapman and Hall/CR
3. Nanostructured Materials and Nanotechnology, **Hari Singh Nalwa**, Academic Press, 2002
4. Organic and Inorganic Nanostructures, **A. Nabok**, Artech House, 2005
5. Nanoscience: “Nanotechnologies and Nanophysics”, **C. Dupas, P. Houdy, M. Lahmani** Springer-Verlag Berlin Heidelberg, 2007