

GUJARAT TECHNOLOGICAL UNIVERSITY

NANO TECHNOLOGY (39)

ELEMENTS OF NANOSCIENCE AND NANOTECHNOLOGY-I

SUBJECT CODE: 2130402

B.E. 3RD SEMESTER

Type of course: Nanoscience and Nanotechnology

Prerequisite: To understand above subject knowledge of optical physics, inorganic chemistry, crystal structure of materials (Crystal Physics), and electrical and magnetic properties of materials syllabus up to 12th Science level are required.

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

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	0	3	70	20	10	0	0	0	100

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	NANOTECHNOLOGY: Background, what is nanotechnology, types of nanotechnology and nano-machines, top down and bottom up techniques, Molecular nanotechnology, atomic manipulation-nanodots, self-assembly, Dip pen nanolithography, Simple details of characterization tools-SEM, TEM, STM,AFM.	5	15
2	NANOMATERIALS : What are Nanomaterials? Preparation of Nanomaterials-Plasma arcing, Chemical Vapor Deposition, Sol-gels techniques, Electrodeposition, Ball Milling, Natural Nanomaterials, Applications of Nanomaterials-Insulation materials, Machine tools, Phosphors, Batteries, High power magnets Medical implants.	7	20
3	NEW FORMS OF CARBON: Carbon tubes-types of nanotubes, formation of nanotubes, Assemblies, purification of Carbon nanotubes, Properties of nanotubes, applications of nanotubes.	6	15
4	OPTICS, PHOTONICS AND SOLAR ENERGY: Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, Solar cells, Nanoparticles and nanostructures; Optically useful nanostructured polymers, Photonic Crystals.	6	15
5	NANOELECTRONICS: Introduction, Tools of Micro- and Nanofabrication-optical and electron beam lithography, Molecular beam	6	15

	lithography, Quantum electronic devices, Molecular electronics, Simple ideas about quantum computers.		
6	APPLICATIONS : MEMS, robots, Nanomachines, Nanodevices, New Computing System, Optic-electronic devices, Environmental applications, Nanomedicine, Biological Nano-Technological future.	10	20

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

Course Outcome:

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

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.