

NANO TECHNOLOGY

(Professional Elective-1)

Course Code: 15CH1114

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Course Outcomes:

On successful completion of the course, the student should be able to

- CO 1** Define and classify the various nanomaterials.
- CO 2** State the applications of nanomaterials
- CO 3** Select different techniques in practice for analyzing the nanomaterials.
- CO 4** Discuss the different synthesis methods for producing the nanomaterials.
- CO 5** Revise the properties and their importance in applications.

UNIT-I (10 Lectures)

Introduction to Nano Technology, Carbon NanoTubes (CNTs), Porous Silicon, Aerogels, Zeolites, Ordered Porous Materials Using Micelles as Templates, Self Assembled Nanomaterials, Core- Shell Particles.

APPLICATIONS:

Electronics, Energy, Automobiles, Sports and Toys, Textiles, Cosmetics, Domestic Appliances, Biotechnology and Medical Fields, Space and Defense, Nanotechnology and Environment.

UNIT-II (10 Lectures)

STRUCTURE AND BONDING:

Arrangement of Atoms, Two Dimensional Crystal Structures, Three Dimensional Crystal structures, Some Examples of Three Dimensional Crystals, Planes in the Crystals, Crystallographic Directions, Reciprocal Lattice, Quasi Crystals, Bonding in Solids.

ANALYSIS TECHNIQUES:

Microscopes, Electron Microscopes, Scanning Probe Microscopes (SPM), diffraction Techniques, Spectroscopy, Magnetic Measurements.

UNIT-III**(10 Lectures)****SYNTHESIS OF NANOMATERIALS-I (PHYSICAL METHODS):**

Mechanical Methods, Methods based on Evaporation, Sputter Deposition, Chemical Vapor Deposition(CVD), Electric Arc Deposition, Ion Beam Techniques (Ion Implantation), Molecular Beam Epitaxy(MBE).

UNIT-IV**(10 Lectures)****SYNTHESIS OF NANOMATERIALS-II (CHEMICAL METHODS):**

Colloids and Colloids in solutions, Growth of Nanoparticles, Synthesis of Metal Nanoparticles by Colloidal Route, Synthesis of Semiconductor Nanoparticles by Colloidal Route, Langmuir-Blodgett(L-B) method, Microemulsion, Sol-Gel Methods.

SYNTHESIS OF NANOMATERIALS-III (BIOLOGICAL METHODS):

Synthesis Using Microorganisms, Synthesis Using Plant Extracts, Use of Proteins and Templates like DNA.

UNIT-V**(10 Lectures)****PROPERTIES OF NANOMATERIALS:**

Mechanical Properties, Structural Properties, Melting of Nanoparticles, Electrical Conductivity, Optical Properties, Magnetic Properties.

TEXT BOOKS:

1. Sulabha.K.Kulkarni., “*Nanotechnology: Principles and Practices*”, Capital Publishing Company, New Delhi, 2nd Edition, 2011.
2. Wilson, M., Kamali K, Smith, G.,Simmons, M. and Raguse, B., “*Nanotechnology: Basic Science and Emerging*

Technologies”, Overseas Press India Pvt. Ltd. New Delhi, 2005.

REFERENCE:

1. Ratner, M. and Ratner, D., “*Nanotechnology : A gentle Introduction to the next big idea*”, Pearson Education and Dorling Kindersley Publishing, 2003.