

**III Year I Semester**

**L T P C**

**Code: 20ME5316**

**3 0 0 3**

## **NANO MATERIALS AND TECHNOLOGY**

### **Course Objective:**

On successful completion of the course, students should be able to:

1. Understand the basic scientific concepts of nano science. Understand the properties of nano materials, characterization of materials, synthesis and fabrication.
2. Understand the applications of nano technology in various science, engineering and technology fields.

### **UNIT I INTRODUCTION**

History of nano science, definition of nano meter, nano materials, nanotechnology. Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin films, applications of quantum dots.

### **UNIT II CRYSTALLOGRAPHY & PROPERTIES OF MATERIALS**

Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure, Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

### **UNIT III SYNTHESIS AND FABRICATION**

Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – nanostructures, growth techniques for nano structures.

### **UNIT IV CHARACTERIZATION TECHNIQUES**

X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezo response microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

### **UNIT V CARBON NANOTECHNOLOGY**

Characterization of carbon allotropic forms, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalline diamond films, graphene, applications of carbon nano tubes.

### **TEXT BOOKS:**

1. Nano science and nanotechnology by M.S Ramachandra Rao, Shubra Singh, Wiley publishers.

**REFERENCE BOOKS:**

1. Introduction to Nano Technology by Charles P. Poole, Jr., Frank J.Owens, Wiley publishers.
2. Nanotechnology by Jermy J Ramsden, Elsevier publishers.
3. Nano Materials- A.K. Bandyopadhyay / New Age Introdu.
4. Nano Essentials-T.Pradeep/TMH.
5. Nanotechnology the Science of Small by M.A Shah, K.A Shah, Wiley Publishers.
6. Principles of Nanotechnology by Phani Kumar, Scitech.

**Weblinks/ Online Resources:**

1. <https://www.electronicsforu.com/resources/15-free-ebooks-on-nanotechnology><https://en.wikipedia.org/wiki/Nanotechnology><https://nptel.ac.in/courses/118104008>
2. <https://nptel.ac.in/courses/118102003>

**Course Outcomes:**

By the end of the course the student would be able to Learn:

- CO1: The basic concepts of Nano materials and technology.
- CO2: Properties of nano materials.
- CO3: Characterization of Nano materials
- CO4: Working Principles and performance evaluation of different types of microscopy, spectroscopy.
- CO5: The applications of nano materials and technology.