### III B. Tech – I Semester (20ME5316) NANO MATERIALS AND TECHNOLOGY

Int. Marks Ext. N	farks Total Marks
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**30 70 100** 

**Pre-Requisites:** Engineering physics, Engineering chemistry, Material science **Course Objective:** 

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

- Understand the basic scientific concepts of nano science. Understand the properties of nano materials, characterization of materials, synthesis and fabrication.
- 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 fins, 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, op to 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 allot ropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalling diamond films, grapheme, applications of carbon nano tubes.

#### **Course Outcomes:**

After successful completion of the course, the students will be able to:

S. No	Course Outcome					
1.	Narrate the basic concepts of Nano materials and technology.	L2				
2.	Explain properties of nano materials.	L2				
3.	Illustrate Characterization of Nano materials	L2				
4.	Illustrate Working Principles and performance evaluation of different types of microscopy, spectroscopy.	L2				
5.	List out applications of nano materials and technology.	L2				

Raghu Engineering College (A)

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### **Correlation of COs with POs& PSOs:**

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	3	2	3	2	3	2	3	3	2
CO2	3	2	3	2	3	3	2	3	2	3	2	3	2	2
CO3	3	2	3	2	3	3	2	3	2	3	2	3	3	2
CO4	3	2	3	2	3	3	2	3	2	3	2	3	3	1
CO5	3	2	3	2	3	3	2	3	2	3	2	3	2	2

## **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-onnanotechnologyhttps://en.wikipedia.org/wiki/Nanotechnologyhttps://nptel.ac.in/courses/118104008
- 2. https://nptel.ac.in/courses/118102003