B.Tech III Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19ABS45-Chemistry of Nanomaterials and applications

(Open Elective-II)

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Course Objectives:

- To understand synthetic principles of Nanomaterials by various methods
- And also characterize the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

UNIT – 1: Introduction to nanoscience **8 Hrs**

Introduction, importance of nanomaterials, nanoscience in nature, classification of nanostructured materials, properties, scope of nanoscience and nanotechnology& applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify the nanostructure materials **L2**
- Describe scope of nanoscience and technology **L2**
- Explain different synthetic methods of nanomaterials **L2**
- Identify the synthetic methods of nanomaterial which is suitable for preparation of particular material **L3**

UNIT – II: : Synthesis of nanomaterials **10 Hrs**

Bottom-Up approach:- Sol-gel synthesis, micro emulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis.

Top-Down approach:- Arc discharge Plasma arc method, aerosol synthesis, ion sputtering, laser pyrolysis, laser ablation, chemical vapour deposition method, electro deposition method, and high energy ball milling.

Learning Outcomes:

At the end of this unit, the student will be able to

- Describe the top down approach **L2**
- Explain aerosol synthesis and plasma arc technique **L2**
- Differentiate chemical vapour deposition method and electrodeposition method **L2**
- Discuss about high energy ball milling **L3**

UNIT – III: Characterization nanomaterials **7 Hrs**

Techniques for characterization: Dynamic light scattering for particle size determination, Diffraction technique, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis

Learning Outcomes:

At the end of this unit, the student will be able to

- Discuss different technique for characterization of nanomaterial **L3**
- Explain electron microscopy techniques for characterization of nanomaterial **L3**
- Describe BET method for surface area analysis **L2**
- Apply different spectroscopic techniques for characterization **L3**

UNIT – IV: Structural studies of nanomaterials **8 Hrs**

Properties of nanomaterials: fullerenes, carbon nanotubes, core-shell nanoparticles. Nano-crystalline materials, magnetic nanoparticles and important properties in relation to nano-magnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain synthesis and properties and applications of nanaomaterials **L2**
- Discuss about fullerenes and carbon nanotubes **L3**
- Differentiate nanomagnetic materials and thermoelectric materials **L2**
- Describe liquid crystals **L2**

UNIT – V: Applications of Nanomaterials **7 Hrs**

Engineering, medicine, aerospace applications of nanomaterials

Learning Outcomes:

At the end of this unit, the student will be able to

- Illustrate applications of nanaomaterials **L2**
- Discuss the magnetic applications of nanomaterials **L3**
- List the applications of non-linear optical materials **L1**
- Describe the applications fullerenes, carbon nanotubes **L2**

Text Books:

1. NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012

Reference Books:

1. Ludovico Cademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Concepts of Nanochemistry; Wiley-VCH, 2011.
2. Guozhong Cao, Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Imperial College Press, 2007
3. C. N. R. Rao, Achim Muller, K.Cheetham, Nanomaterials Chemistry, , Wiley-VCH, 2007

Course Outcomes:

At the end of this Course the student will be able to

- Understand the state of art synthesis of nano materials **L1**
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry. **L2**
- Analyze nanoscale structure in metals, polymers and ceramics **L3**
- Analyze structure-property relationship in coarser scale structures **L3**
- Understand structures of carbon nano tubes **L1**