

SSLC, HSE, DIPLOMA, B.E/B.TECH, M.E/M.TECH, MBA, MCA

Notes

Syllabus

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OML551 INTRODUCTION TO NANOTECHNOLOGY

DETAILED SYLLABUS

OBJECTIVE:

Make the students to understand about the nanomaterials, synthesis and its characterization.

UNIT I BASICS AND SCALE OF NANOTECHNOLOGY

Introduction –Scientific revolutions –Time and length scale in structures –Definition of a nano system –Dimensionality and size dependent phenomena –Surface to volume ratio -Fraction of surface atoms –Surface energy and surface stress- surface defects-Properties at nanoscale (optical, mechanical, electronic and magnetic).

UNIT II DIFFERENT CLASSES OF NANOMATERIALS

Classification based on dimensionality-Quantum Dots, Wells and Wires- Carbon- based nano materials (buckyballs, nanotubes, graphene)–Metal based nano materials (nanogold, nano silver and metal oxides) -Nanocomposites- Nano polymers –Nano glasses –Nano ceramics - Biological nanomaterials.

UNIT III SYNTHESIS OF NANOMATERIALS

Classification of synthesis: Top down and bottom-up nanofabrication. Chemical Methods: Metal Nanocrystals by Reduction - Solvothermal Synthesis- Photochemical Synthesis – Sono chemical Routes- Chemical Vapor Deposition (CVD) –Metal Oxide - Chemical Vapor Deposition (MOCVD). Physical Methods: Ball Milling –Electrodeposition - Spray Pyrolysis - Flame Pyrolysis - DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE)

UNIT IV FABRICATION AND CHARACTERIZATION OF NANOSTRUCTURES

Nanofabrication: Photolithography and its limitation-Electron-beam lithography (EBL)- Nanoimprint –Soft lithography patterning. Characterization: Field Emission Scanning Electron Microscopy (FESEM) –Environmental Scanning Electron Microscopy (ESEM) High Resolution Transmission Electron Microscope (HRTEM) –Scanning Tunnelling Microscope (STM) Surface enhanced Raman spectroscopy (SERS)- X-ray Photoelectron Spectroscopy (XPS) - Auger electron spectroscopy (AES) –Rutherford backscattering spectroscopy (RBS).

UNIT V APPLICATIONS

Solar energy conversion and catalysis - Molecular electronics and printed electronics - Nanoelectronics -Polymers with aspecial architecture - Liquid crystalline systems - Linear and nonlinear optical and electro-optical properties, Applicationsin displays and other devices - Nanomaterials for data storage - Photonics, Plasmonics- Chemical and biosensors Nanomedicine and Nanobiotechnology –Nanotoxicology challenges.

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TEXT BOOKS

1. Bhusan, Bharat (Ed), "Springer Handbook of Nanotechnology", 2nd Edition, 2007.
2. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2002.
3. Pradeep T., "A Textbook of Nanoscience and Nanotechnology", Tata McGraw Hill Education Pvt. Ltd., 2012.

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1. Charles P. Poole Jr., Frank J. Ownes, 'Introduction to Nanotechnology', Wiley Interscience, 2003.
2. Dupas C., Houdy P., Lahmani M., "Nanoscience: Nanotechnologies and Nanophysics", Springer-Verlag Berlin Heidelberg, 2007.
3. Mark Ratner and Daniel Ratner, "Nano Technology", Pearson Education, New Delhi, 2003.
4. Nabok A., "Organic and Inorganic Nanostructures", Artech House, 2005.