



Central University of Himachal Pradesh

[Established under Central Universities Act 2009]

School of Earth & Environmental Sciences

Department of Environmental Sciences

Course Code: ENV 528

Course Name: *Nano-Techniques and Environment*

Semester: Ist

Credits: 2

L: 24

UNIT – I

Introduction to nanomaterials, Properties of materials & nanomaterials, role of size in nanomaterials, 0D, 1D, 2D structures – Size Effects – Fraction of Surface Atoms – specific Surface Energy, Different classes of nanomaterials quantum dots, wells and wires.

UNIT – II

Physical method of synthesis of nanoparticles: high energy ball milling, Chemical Routes for Synthesis of Nanomaterials: Chemical precipitation and co-precipitation, chemical vapor deposition (CVD), nucleation and growth of nanoparticles, synthesis of metal and semiconductor nanoparticles by colloidal route, microemulsions

UNIT – III

Experimental Techniques: Scanning and Transmission electron microscopy, difference between SEM and TEM, Energy-Dispersive X-ray Spectroscopy (EDS), UV-visible spectroscopy, X-ray photoelectron spectroscopy, X-ray diffraction, Scherrer equation and its limitation, Energy dispersive X-ray analysis, Atomic force microscope,

UNIT – IV

Advanced nanomaterials for drug delivery and cancer therapy, Dye-sensitized Photovoltaic Solar Cell (Grätzel Cell), Hydrogen evolution reaction (HER) and Oxygen evolution reaction (OER), Fuel Cell, Sensing and Photodegradation Reaction.

Books Recommended:

1. Nanotechnology: Principles and Practices, Sulabha K. Kulkarni,
2. Introduction to nanotechnology: Charles P. Poole, Jr. Frank, J. Owens: Wiley India
3. Nanotechnology: Basic Science and Emerging Technologies, M. Wilson, K. Kannangara, G. Smith.
4. H. S. Nalwa (ed.), Encyclopedia of Nanoscience and Nanotechnology, American Scientific Publishers, Los Angeles (2004), Vol. 1–25.