



Department of Physics and Astronomical Science Central University of Himachal Pradesh



(Established under Central Universities Act 2009)
DHARAMSHALA, DISTRICT KANGRA – 176215
HIMACHAL PRADESH
www.cuhimachal.ac.in

Course Name: NANO MATERIALS

Type: IDC

Credit: 2

CODE: PAS 5111

Level: 5 (B.Sc. 1st Semester)

Credits Equivalent:

(One credit is equivalent to 10 hours of lectures / organized classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

Course Objective: Understand (i) the effect of dimensionality of the object at nanoscale on their properties (ii) shape and size controlled synthesis of nanomaterials, characterizations and their future applications in industry.

Course Outcomes: After completing the course satisfactorily, a student will be able to apply principles of basic science concepts in understanding, analysis and prediction of matter at Nano scale.

Attendance Requirements:

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

Evaluation Criteria:

Mid Term Examination:20%

End Term Examination:60%

Continuous Internal Assessment: 20%. i.e. 20 marks out of 100

Course contents

Unit-1 APPLICATIONS 6.4.1 NANOSCALE SYSTEMS:

Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences.

(10 Lectures)

Unit-2 SYNTHESIS OF NANOSTRUCTURE MATERIALS:

Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electrodeposition. Spray pyrolysis. Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dots.

(8 Lectures)

Unit-3 CHARACTERIZATION:

X-Ray Diffraction, Scanning Electron Microscopy, Transmission Electron Microscopy.

(4 Lectures)

Prescribed Text Book:

1. ..Quantum Mechanics Concepts and Applications Second Edition Nouredine Zettili
Jacksonville State University, Jacksonville, USA
2. ..Nanostructures & Nanomaterials Synthesis, Properties G;Z: Applications