Department of Physics & Astronomical Science
School of Physical & Material Sciences
Central University of Himachal Pradesh
(Established under Central Universities Act 2009)
Shahpur Campus, DISTRICT KANGRA – 176206
HIMACHAL PRADESH
www.cuhimachal.ac.in

Course: NANO MATERIALS

Course Code: **PAS IDC 5201**
Course Type: Interdisciplinary Course
Course Credits: 2

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:

- Apply principles of basic science concepts in understanding, analysis and prediction of matter at Nano scale.

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

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Course: WAVES AND OPTIC

Course Code: IDC 5202
Course Type: Value Added Course
Course Credits: 2

Course Outcomes-

- After reading this course students will be able to waves, lights etc.
- Students will be able to see the difference between interference and diffraction.
- Students will be able to understand plane waves etc.

1. **Superposition of Collinear Harmonicoscillations**:(3Lectures)

LinearityandSuperpositionPrinciple.Superposition of two collinear oscillations having (1)equalfrequenciesand(2)differentfrequencies
(Beats).Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences.

2. **Superposition of two perpendicular Harmonic Oscillations**

GraphicalandAnalyticalMethods.Lissajous Figureswithequalanunequalfrequencyand their uses.

3 **Wave Motion**:(4 Lectures)

PlaneandSphericalWaves.Longitudinaland
TransverseWaves.PlaneProgressive(Travelling)Waves.WaveEquation.Particleand WaveVelocities.DifferentialEquation.PressureofaLongitudinalWave.Energy Transport.Intensity of Wave.Water Waves:Ripple and Gravity Waves.

4 **VelocityofWaves**:(3Lectures)

VelocityofTransverseVibrationsofStretched Strings.VelocityofLongitudinalWavesina Fluid in a Pipe.Newton's Formula for Velocity of Sound.Laplace's Correction.

5 **SuperpositionofTwoHarmonic Waves**:(6 Lectures)

Standing (Stationary) Waves in a String:Fixed andFreeEnds.AnalyticalTreatment.Phasecand Group Velocities.Changes with respect to
Position and Time.Energy of Vibrating String. Transfer of Energy.Normal Modes of Stretched

Strings.PluckedandStruckStrings.Melde's Experiment.Longitudinal Standing Waves and NormalModes.OpenandClosed Pipes.Superposition of N Harmonic Waves.
Electromagnetic nature of light.Definition and propertiesofwavefront.HuygensPrinciple.Temporal and Spatial Coherence.

6 **Interference**:(2 Lectures)

Divisionofamplitudeandwavefront.Young's double slit experiment.Lloyd's Mirror and Fresnel's Biprism.Phase change on reflection:Stokes'treatment.Interference in Thin Films:parallel MichelsonInterferometer-(1)Ideaofformof fringes (No theory required), (2) Determination ofWavelength,(3)WavelengthDifference,(4) Refractive Index,and (5)Visibility of Fringes.Fabry-Perot interferometer.
Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula.(Qualitative discussion only) source holograms

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Reference Books:

1.Waves:BerkeleyPhysicsCourse,vol.3, FrancisCrawford,2007,TataMcGraw-Hill.
2.Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
3.Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.