

Sir Padampat Singhania University
Bhatewar, Udaipur
School of Engineering

LESSON PLAN

PH 301 (Introduction to Nanotechnology)

Credits: 2 - 0 - 0- 2

Course Leader: Prof. K. K. Sud

Course Instructors: Prof. K. K. Sud and Dr. Ghanshyam Purohit

S. No.	Topics	Lecture Hours
1.	Introduction – what is Nano?, Nanomaterials	2
2.	Review of classical mechanics, Black body radiation, Planck's hypothesis, de Broglie's hypothesis, Heisenberg uncertainty principle	1
3.	Schrödinger's equation, Properties of the wave function, particle in a box, potential barrier, particle tunneling	1
4.	Hydrogen atom problem, Pauli Exclusion Principle, spin of electron, Zeeman effect	1
5.	Structure and bonding, lattice vibration, energy bands – insulators, semiconductors and conductors, energy gape of semiconductors	2
6.	Fermi surfaces, localized particles, donors, acceptors, deep traps, mobility and excitons	1
7.	Concepts of quantum well, wires and dots, properties of quantum nanoclusters, bottom-up and top-down methods	1
8.	size effects, conduction electrons and dimensionality	1
9.	Fermi gas and density of states, potential wells, partial confinement	1
10.	Applications – infrared detectors, Quantum dot lasers	1
11.	Synthesis of nanomaterials – Physical and chemical methods	3
12.	Structural characterization of nanomaterials using XRD, TEM, SEM, STM, AFM	3
13.	Carbon molecules and clusters, C60, alkali doped C60, Carbon nanotubes –Fabrication, structure, electrical properties, vibrational and mechanical properties	2
14.	Applications of the carbon nanotubes, Field emission and shielding, Field effect transistors and switching devices	1
15.	Fuel cells, sensors and mechanical reinforcement, single electron transistors, Esaki and resonant tunneling diodes	1
16.	Magic numbers, Model for nanoclusters, Geometrical and Electronic structure, Semiconducting nanoclusters	1
17.	Nanobiotechnology – Introduction, Biological building blocks – size of building blocks and nanostructures, Polypeptide Nanowire and Protein Nanoparticle, Nucleic acids	2
18.	Biological nanostructures, examples of proteins, applications of nanobiotechnology	1

Total Lecture Hours: 26