AMITY UNIVERSITY
UTTAR PRADESH

Annexure **'CD-01'**

Course Title: QUANTUM CONCEPTS OF NANOSTRUCTURES

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	1	0	0	4

Course Code: to be decided later

Credit Units: 4

Level: UG/PG

Course Title	**Weightage %**
Course Objectives: This course will provide each student with an exposure to understand the quantum concepts of nano-structures and of controlling the properties of these nano-structures.	
Prerequisites: **Understanding of Modern Physics**.	
Student Learning Outcomes: • To understand the role of quantum phenomena in materials characteristics • To understand the role of quantum mechanics in nanoscience and nanotechnology. • To analyze the experimental data in quantum regime	
Module I : Revisit to Modern Physics basics	
Particle nature of radiation, Elements of quantum mechanics, Photoelectric effect, Compton effect, wave nature of particle, Uncertainty principle, DeBroglie wavelength and exciton Bohr radius, Atomic orbitals, The energies and sizes of the atomic orbitals, Atomic orbitals: shape and nomenclature, Angular momentum: interpretation of *l* and *m*,	**15**

Module II: Confinement & Transmission Phenomenon	
Schrodinger's Equation, Particle in a 1D box, a 2D box and a 3D box. Particle in a box, Harmonic oscillator, Hydrogen atom, Transmission above and below the barrier, The complete transmission function $T(\varepsilon)$, The transmission and reflection coefficients T and R in 1D, Electron waves and the simple potential step, Tunneling through a potential barrier	**40**
Module III : Transport in nanostructures	
Nanostructures connected to electron reservoirs, Current density and transmission of electron waves, Electron waves in constant potentials in 1D, The current density **J,**. Transfer and scattering matrices, Conductance and scattering matrix formalism	**25**
Module IV : Quantized Conductance	
Current, reservoirs, and electron channels, The conductance formula for nanostructures Quantized conductance	**20**
Pedagogy for Course Delivery: The subject will be taught with the help of • Class room teaching in form of Lectures, face to face interaction and doubt clarification • Power point presentations to discuss mathematical derivation on technical development. .	
Assessment / Examination Scheme:	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					**End Term Examination**
Component (Drop down)	Mid-Term	HA	Viva	Attendance	

	Exam				
Weightage (%)	15	5	5%	5%	70%

Text:

- Introduction to nanotechnology -Charles P. Poole. Jr. and Franks .J. Qwens.
- Nanostructures: Synthesis, Functional Properties and Applications - T. Tsakalakos, I. A. Ovid'ko, A.K. Vasudevan
- Quantum Mechanics- (i)Bransden and Jouchen, (ii) Schiff, (iii) Iceberg and Resnick (iv) Kamal Singh & S.P. Singh