

Course Syllabi: UPH061 Modern Physics (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UPH061; Modern Physics
2. **Credits and contact hours:** Credits: 3.5; Hours: 4
3. **Text book, title, author, and year**
 - *Beiser, A., Concept of Modern Physics, McGraw Hill Publications (1997).*
 - *Singh, J., Modern Physics for Engineers, John Willey & Sons (2005).*
 - *Eisberg, R., and Resnick, R., Quantum Physics of Atoms, Solids, Nuclei and Particles, John- Willey (2003).*
 - *Bernstein, J., Fishbane, P.M., Gasiorowicz, S., Modern Physics, Pearson Education (2003).*
 - a. Other supplemental materials
 - Nil
4. **Specific course information**
 - a. Brief description of the content of the course (catalog description)

Need of Modern Physics: Overview of Classical, Wave Packet and Uncertainty Principle, Need for Quantum Mechanics, Waves as particles: Black Body Radiation, Photoelectric Effect, Particles as Waves. Specific Heat of Metals, Atomic Spectra, Wave Particle Duality.

Evolution of Quantum Mechanics: Schrodinger Wave Equations, Wave Functions, Expectation Value, Ehrenfest Theorem, Particle in a Box, Finite Potential Well, Harmonic Oscillator, Tunneling Effect.

Applications of Quantum Mechanics: Ohmic Contacts. Field Emission Devices, Scanning Tunneling Microscopy, Tunneling in Semiconductor Diodes and Superconductors., Free Particle Problems and Density of State, Particle in a Periodic Potential; Bloch Theorem; Kronig-Penney Model for Band Structure and its Applications in Metals, Insulators, Semiconductors and Superconductors.

Quantum Statistics: Maxwell-Boltzman Statistics, Need for Quantum Statistics, Bose-Einstein and Fermi, Dirac(FD) statistics; Applications of Bose Einstein Statistics to Photons and Phonons, Application of FD Statistics to FD Degeneracy of Electron Gas in Metals; Heat Capacity of Metals; Einstein and Debye Model of Solids.
5. **Specific goals for the course**

After the completion of the course, the students will be able to:

 - Explain the basic concepts of quantum physics such as wave packet and uncertainty principle.
 - Describe the evolution of quantum mechanics.
 - Demonstrate the application of quantum mechanics.
 - Explain the basics of quantum statistics.
6. **Brief list of topics to be covered**
 - Need of Modern Physics
 - Evolution of Quantum Mechanics
 - Applications of Quantum Mechanics
 - Quantum Statistics