Course Syllabi: UPH004: Applied Physics (L : T : P :: 3 : 1 : 2)

1. **Course number and name**: UPH004: Applied Physics

2. **Credits and contact hours**: 4.5 and 6

3. **Text book, title, author, and year**

   Text Books / Reference Books
   - *Beiser, A., Concept of Modern Physics, Tata McGraw Hill (2007) 6thed.*
   - *Griffiths, D.J., Introduction to Electrodynamics, Prentice Hall of India (1999) 3rded.*
   - *Jenkins, F.A. and White, H.E., Fundamentals of Optics, McGraw Hill (2001) 4thed.*
   - *Wehr, M.R, Richards, J.A., Adair, T.W., Physics of The Atom, Narosa Publishing House (1990) 4th ed.*
   - *Verma, N.K., Physics for Engineers, Prentice Hall of India (2014)1sted.*
   - *Pedrotti, Frank L., Pedrotti, Leno S., and Pedrotti, Leno M., Introduction to Optics, Pearson Prentice Hall^{TM} (2008) 3rded.*

     a. Other supplemental materials
        - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   Oscillations and Waves: Oscillatory motion and damping, Applications - Electromagnetic damping – eddy current; *Acoustics:* Reverberation time, absorption coefficient, Sabine's and Eyring's formulae (Qualitative idea), Applications - Designing of hall for speech, concert, and opera; *Ultrasonics:* Production and Detection of Ultrasonic waves, Applications - green energy, sound signalling, dispersion of fog, remote sensing, Car's airbag sensor.

   Electromagnetic Waves: Scalar and vector fields; Gradient, divergence, and curl; Stokes' and Green's theorems; Concept of Displacement current; Maxwell's equations; Electromagnetic wave equations in free space and conducting media, Application - skin depth.

   Optics: *Interference:* Parallel and wedge-shape thin films, Newton rings, Applications as Non-reflecting coatings, Measurement of wavelength and refractive index. *Diffraction:* Single and Double slit diffraction, and Diffraction grating, Applications - Dispersive and Resolving Powers. *Polarization:* Production, detection, Applications – Anti-glare automobile headlights, Adjustable tint windows. *Lasers:* Basic concepts, Laser properties, Ruby, HeNe, and Semiconductor lasers, Applications – Optical communication and Optical alignment.

   Quantum Mechanics: Wave function, Steady State Schrodinger wave equation, Expectation value, Infinite potential well, Tunnelling effect (Qualitative idea), Application - Quantum computing.

   Laboratory Work:
   - Determination of damping effect on oscillatory motion due to various media.
   - Determination of velocity of ultrasonic waves in liquids by stationary wave method.
   - Determination of wavelength of sodium light using Newton's rings method.
   - Determination of dispersive power of sodium-D lines using diffraction grating.
   - Determination of specific rotation of cane sugar solution.

- Study and proof of Malus' law in polarization.
- Determination of beam divergence and beam intensity of a given laser.
- Determination of displacement and conducting currents through a dielectric.
- Determination of Planck's constant

5. Specific goals for the course

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

- Understand damped and simple harmonic motion, the role of reverberation in designing a hall and generation and detection of ultrasonic waves.
- Use Maxwell's equations to describe propagation of EM waves in a medium.
- Demonstrate interference, diffraction and polarization of light.
- Explain the working principle of Lasers.
- Use the concept of wave function to find probability of a particle confined in a box.

6. Brief list of topics to be covered

- Oscillations and Waves
- *Ultrasonics*
- Electromagnetic Waves
- Optics, *Polarization, Lasers*
- Quantum Mechanics