ENGINEERING PHYSICS SYLLABUS

Module 1: Introduction to Waves

- Waves on a String
- Wave Equation on a String (Derivation)
- Harmonic Waves
- Reflection and Transmission of Waves at a Boundary (Qualitative)
- Standing Waves and Their Eigenfrequencies

Module 2: Electromagnetic Waves

- Physics of Divergence, Gradient, and Curl
- Qualitative Understanding of Surface and Volume Integral
- Maxwell's Equations (Qualitative)
- Displacement Current
- Electromagnetic Wave Equation in Free Space
- Plane Electromagnetic Waves in Free Space
- Hertz's Experiment

Module 3: Elements of Quantum Mechanics

- Need for Quantum Mechanics
    - Idea of Quantization (Planck and Einstein)
    - Compton Effect (Qualitative)
- de Broglie Hypothesis
- Davisson-Germer Experiment
- Wave Function and Probability Interpretation
- Heisenberg Uncertainty Principle
- Schrödinger Wave Equation (Time-Dependent and Time-Independent)

Module 4: Applications of Quantum Mechanics

- Eigenvalues and Eigenfunctions of a Particle Confined in One-Dimensional Box
- Basics of Nanophysics
- Quantum Confinement and Nanostructures
- Tunnel Effect (Qualitative) and Scanning Tunneling Microscope

Module 5: Lasers

- Laser Characteristics: Spatial and Temporal Coherence
- Einstein Coefficients and Their Significance
- Population Inversion: Two, Three, and Four Level Systems
- Pumping Schemes and Threshold Gain Coefficient
- Components of a Laser
- Types of Lasers and Engineering Applications:
    - He-Ne Laser
    - Nd
      Laser
    - CO_2 Laser

Module 6: Propagation of Electromagnetic Waves in Optical Fibers

- Introduction to Optical Fiber Communication System
- Light Propagation through Fibers
- Acceptance Angle
- Numerical Aperture
- V-Parameter
- Types of Fibers
- Attenuation and Dispersion
    - Intermodal and Intramodal Dispersion
- Application of Optical Fibers in Medicine (Endoscopy)

Module 7: Optoelectronic Devices

- Light Sources: LED and Laser
- Introduction to Semiconductors: Direct and Indirect Bandgap Diode
- Photodetectors: PN Junction and PIN Diodes