Kerala Technological university KTU First year B.tech Syllabus for **PH100 ENGINEERING PHYSICS**

Course No. : PH100

Course Name: ENGINEERING PHYSICS

L-T-P-Credits: 3-1-0-4

Year of Introduction: 2015

Course Objectives:

Most of the engineering disciplines are rooted in Physics. In fact a good engineer is more or less an applied physicist. This course is designed to provide a bridge to the world of technology from the basics of science and to equip the students with skills in scientific inquiry, problem solving, and laboratory techniques.

Syllabus:

Harmonic Oscillations: Damped and Forced Harmonic Oscillations. Waves: One Dimensional and Three Dimensional waves, Crystal Structure: Crystal planes and Directions, Miller indices Superconductivity: Properties and Applications, Interference: Interference in thin films (Reflected system) Diffraction: Fraunhofer and Fresnel Diffraction, Grating, Polarization of Light: Double refraction, production and detection of polarized light, Quantum Mechanics: Schrodinger Equations- Formulation and Solution, Operators, Applications. Statistical Mechanics: Microstates and macro states Maxwell- Boltzmann, Bose-Einstein and Fermi Dirac statistics, Planck's Radiation formula, Acoustics: Intensity of sound, Reverberation and design concepts, Ultrasonics: Production, Detection and Applications, NDT methods, Lasers: Properties, Working Principles, Practical Lasers. Photonics: Basics of Solid State lighting, Photo detectors, Solar Cells, Fiber Optics.

Expected outcome:

Familiarity with the principles of Physics and its significance in engineering systems and technological advances.

Text Book:

1. Aruldhas. G, Engineering Physics PHI Ltd
2. A Text Book of Engineering Physics, A.S. Vasudeva, S. Chand & Co
3. Applied Physics for Engineers, Neeraj Mehta, PHI Ltd

References:

1. Engineering Physics, Premlet.B, Mc GrawHill India Ltd
2. Engineering Physics, B.K. Pandey, S. Chathurvedi, Cengage Learning
3. Engineering Physics , Bhattacharya and Tandon , Oxford India
4. Concepts of Modern Physics, Arthur Beiser, 6e, McGrawHill India Ltd
5. Optics , Eugene Hecht, 4e, Pearson Education
6. A text book of Optics , Brijlal and Subramanyam, 4e, S.Chand
7. Fiber Optic Communications , Joseph C Palais, 4e, Pearson Education
8. University Physics , Sears and Zemansky, 13e, Pearson

Web:
www.physics.org, www.howstuffworks.com, www.physics.about.com

Module 1 Contents

Oscillations and Waves
Harmonic Oscillations: Differential equation of damped harmonic oscillation, forced harmonic oscillation and their solutions- Resonance, Q factor, Sharpness of resonance- LCR circuit as an electrical analogue of Mechanical Oscillator (Qualitative)
Waves: One dimensional wave- differential equation and solution. Three dimensional waves – Differential equation & its solution. Transverse vibrations of a stretched string.

Module 2 Contents

Crystal Structure, Superconductors

Crystal Structure: Space lattice-Unit cell and lattice parameters-Directions and Planes in crystals- Miller indices- Interplanar spacing in terms of Miller indices. Braggs law- X-ray diffraction
Superconductivity: Superconducting phenomena. Meissner effect. Type-I and Type-II superconductors. BCS theory (qualitative). High temperature superconductors.- Josephson Junction – SQUID- Applications of superconductors.

Module 3 Contents

Physical Optics
Interference: Coherence. Interference in thin films and wedge shaped films (Reflected system) Newton's rings-measurement of wavelength and refractive index of liquid Interference filters. Antireflection coating.
Diffraction: Fresnel and Fraunhofer diffraction. Fraunhofer diffraction at a single slit. Plane transmission grating. Grating equation-measurement of wavelength. Rayleigh's criterion for resolution. Resolving power and dispersive power of grating.
Polarization of Light: Types of polarized light. Double refraction. Nicol Prism. Quarter wave plate and half wave plate. Production and detection of circularly and elliptically polarized light. Laurent's Half shade Polarimeter- Kerr Cell - Polaroids & applications.

Module 4 Contents

Introduction to Quantum Mechanics and Statistical Mechanics
Quantum Mechanics: Uncertainty principle and its applications- formulation of Time dependent and Time independent Schrödinger equations- physical meaning of wave function- Energy and momentum Operators-Eigen values and functions- Expectation values- One dimensional infinite square well potential .Quantum mechanical Tunnelling (Qualitative)
Statistical Mechanics: Macro states and Microstates. Phase space. Basic postulates of Maxwell- Boltzmann, Bose-Einstein and Fermi Dirac statistics.

Distribution equations in the three cases (no derivation). Density of states. Derivation of Planck's radiation formula. Free electrons in a metal as a Fermi gas. Fermi energy

Module 5 Contents

Acoustics and Ultrasonics
Acoustics: Intensity of sound- Loudness-Absorption coefficient - Reverberation and reverberation time - Significance of reverberation time-Sabine's formula (No derivation) - Factors affecting acoustics of a building.
Ultrasonics: Production of ultrasonic waves- Magnetostriction effect and Piezoelectric effect- Piezoelectric oscillator - Detection of ultrasonics - Thermal and piezoelectric methods - Applications of ultrasonics - NDT and medical.

Module 6 Contents

Laser: Properties of Lasers, Absorption, Spontaneous and stimulated emissions, Population inversion, Einstein's coefficients, Working principle of laser, Optical resonant cavity. Ruby Laser, Helium-Neon Laser, Semiconductor Laser (qualitative). Applications of laser, holography (Recording and reconstruction)
Photonics: Basics of solid state lighting- LED -Photo detectors- photo voltaic cell, junction & avalanche photo diodes, photo transistors, Thermal detectors, Solar cells- I-V characteristics –Optic fibre-Principle of propagation-numerical aperture-optic communication system (block diagram) -Industrial, medical and technological applications of optical fibre. Fibre optic sensors - Intensity modulated, phase modulated and polarization modulated sensors.