WAVES AND OPTICS

I Semester: AE / ECE / ME II Semester: EEE / CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB12	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

The course should enable the students to:

I Enrich knowledge in principals of quantum mechanics and semiconductors.
II Correlate principles and applications of lasers and fiber optics.
III Meliorate the knowledge of light and optics.
IV Develop strong fundamentals of transverse, longitudinal waves and harmonic waves.
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COURSE OUTCOMES (COs):

CO 1: Describe the concept of Quantum mechanics, different types of semiconductors, and variations of Fermi level in Extrinsic semiconductors.
CO 2: Understanding the concepts of laser light and its properties, communication in optical fibbers.
CO 3: Understand the different concepts of light, interference, diffraction, polarization concepts.
CO 4: Explore the concept of waves and its propagation in air and water.
CO 5: Understand about waves and its propagation.

COURSE LEARNING OUTCOMES (CLOs):

1. Recall the basic principles of physics and apply these concepts of physics in solving the
2. Real-time problems.
3. Acquire knowledge about fundamental in quantum mechanics.
4. Interpretation of dual nature of matter wave concept using Davisson & Germer's experiment.
5. Estimate the energy of the particles using Schrödinger's wave equation and apply it to particle in potential box.
6. Recollect the conductivity mechanism involved in semiconductors and calculate carrier concentrations.
7. Understand the band structure of a solid and Classify materials as metals, insulators, or semiconductors, and sketch a schematic band diagram for each one.
8. Understand the basic principles involved in the production of Laser light and also
9. Real-time applications of lasers.
10. Recollect basic principle, construction, types and attenuation of optical fibers.
11. Understand the importance of optical fibers in real-time communication system.
12. Apply different laws of radiation to understand the phenomenon behind productionof light.
13. Apply the phenomenon of interference in thin films using Newton's rings experiment.
14. Identify diffraction phenomenon due to slits.
15. Acquire knowledge of basic harmonic oscillators and discuss in detail different types of harmonic oscillators.

MODULE-I	QUANTUM MECHANICS

Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, De-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Time-independent Schrodinger equation for wave function, Born interpretation of the wave function, Schrodinger equation for one dimensional problems–particle in a box.

MODULE-II	INTRODUCTION TO SOLIDS AND SEMICONDUCTORS

Bloch's theorem for particles in a periodic potential, Kronig-Penney model (Qualitative treatment), Origin of energy bands. Types of electronic materials: metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Carrier concentration, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination, Hall effect.

MODULE-III	LASERS AND FIBER OPTICS

Characteristics of lasers, Spontaneous and stimulated emission of radiation, Metastable state, Population inversion, Lasing action, Ruby laser, He-Ne laser and applications of lasers.

Principle and construction of an optical fiber, Acceptance angle, Numerical aperture, Types of optical fibers (Single mode, multimode, step index, graded index), Attenuation in optical fibers, Optical fiber communication system with block diagram.

MODULE-IV	LIGHT AND OPTICS

Huygens' principle, Superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer.
Fraunhofer diffraction from a single slit, circular aperture and diffraction grating.

MODULE-V	HARMONIC OSCILLATIONS AND WAVES IN ONE DIMENSION

Mechanical and electrical simple harmonic oscillators, Damped harmonic oscillator, Forced mechanical and electrical oscillators, Impedance, Steady state motion of forced damped harmonic oscillator.
Transverse wave on a string, the wave equation on a string, Harmonic waves, Reflection and transmission of waves at a boundary, Longitudinal waves and the wave equation for them, acoustics waves.

TEXT BOOKS:

1. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993.
2. R. K. Gaur, S. L. Gupta, "Engineering Physics", DhanpatRai Publications, 8th Edition, 2001.
3. Dr. K. Vijaya Kumar, Dr. S. Chandralingam, "Modern Engineering Physics", Chand & Co. New Delhi, 1st Edition, 2010.

REFERENCES:

1. H.J. Pain, "The physics of vibrations and waves", Wiley, 2006.
2. Ghatak, "Optics", McGraw Hill Education, 2012.
3. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.

WEB REFERENCES:

1. http://link.springer.com/book
2. http://www.thphys.physics.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com

E – TEXT BOOKS:

1. http://www.peaceone.net/basic/Feynman/
2. http://physicsdatabase.com/free-physics-books/
3. http://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf
4. http://www.freebookcentre.net/Physics/Solid-State-Physics-Books.html