COURSE CODE	COURSE NAME	L	T	P	CREDIT	YEAR OF INTRODUCTION
101906/PH900B	ENGINEERING PHYSICS A	4	0	0	4	2021

1. Preamble

The aim of the Engineering Physics Program is to offer students a solid background in the fundamentals of Physics and the foundation of the respective engineering disciplines. The program is designed to develop scientific attitudes in the students and equip them with appropriate engineering professional skills specified as global program outcomes of engineering education to make them future-ready.

2. Prerequisite

Higher secondary level Physics, Mathematical course on vector calculus, differential equations and linear algebra

3. Syllabus

Module 1: Oscillations and Waves

Harmonic oscillations- Damped harmonic motion-Derivation of differential equation and its solution, Over damped, Critically damped and Under damped Cases- Quality factor- Expression - Forced oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance- Expression for Resonant frequency- Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators. Wave motion- Derivation of one-dimensional wave equation and its solution- Three-dimensional wave equation and its solution (no derivation)- Distinction between transverse and longitudinal waves- Transverse vibration in a stretched string- Statement of laws of vibration.

Module 2: Wave Optics

Interference of light-Principle of superposition of waves- Theory of thin films - Cosine law (Reflected system)- Derivation of the conditions of constructive and destructive Interference- Interference due to wedge shaped films -Determination of thickness and test for optical planeness- Newton's rings - Measurement of wavelength and refractive index, Antireflection coatings- Diffraction of light, Fresnel and Fraunhofer classes of

diffraction, Diffraction grating-Grating equation-Rayleigh criterion for limit of resolution-Resolving and Dispersive power of a grating with expression (no derivation)

Module 3: Quantum Mechanics and Nanotechnology

Introduction for the need of Quantum mechanics- Wave nature of Particles- Uncertainty principle- Applications-Absence of electrons inside a nucleus and Natural line broadening mechanism - Formulation of time dependent and independent Schrodinger wave equations-Physical Meaning of wave function- Particle in a one dimensional box-Derivation for normalized wave function and energy eigen values, Quantum Mechanical Tunnelling (Qualitative)- Introduction to nanoscience and technology- Increase in surface to volume ratio for nanomaterials, Quantum confinement in one dimension, two dimension and three dimension-Nano sheets, Nanowires and Quantum dots-Properties of nanomaterials-mechanical, electrical and optical Applications of nanotechnology (qualitative ideas)

Module 4: Magnetism, Electromagnetic Theory and Basics of Solid-State Physics

Gauss's law for Magnetic flux density- Ampere's Circuital law- Faraday's law in terms of EMF produced by changing magnetic flux- Classification of magnetic materials- para, dia and ferromagnetic materials- Magnetic devices-Gauss divergence theorem & Stokes' theorem- Equation of continuity- Derivation of Maxwell's equations in vacuum-Electromagnetic waves- Velocity of Electromagnetic waves in free space- Band theory of solids, Semiconductors- Fermi Dirac distribution, Fermi level and Fermi energy- Bloch theorem, phonons, dispersion relations and phonon modes (Qualitative). Solid state nano devices.

Module 5: Superconductivity and Photonics

Super conducting Phenomena- Meissner effect and perfect diamagnetism- Types of superconductors- Type I and Type II-BCS Theory (Qualitative)- High temperature superconductors, Applications of super conductivity- Introduction to photonics-Photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V Characteristics-Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres, Numerical aperture –Derivation, Fibre optic communication system (block diagram), Industrial, Medical and Technological applications of optical fibre, Fibre optic sensors-Intensity Modulated and Phase modulated sensors

4. Text Books

1. M. N. Avadhanulu, P. G. Kshirsagar and T. V. S. Arun Murthy, *A Text book of Engineering Physics*, Revised Edition, S. Chand & Co., 2019
2. H. K. Malik, A. K. Singh, *Engineering Physics*, 2nd Edition, McGraw Hill Education, 2017.
3. David J Griffiths, *Introduction to Electrodynamics*, 3rd Edition, Addison-Wesley publishing, 1999.
4. Neil Ashcroft and N. David Mermin, *Solid State Physics*, 1st Edition, Cengage, 2003.
5. Hofman and Philip, *Solid state physics: An introduction*, Wiley, 2008.
6. C. Kittel, *Introduction to Solid State Physics*, 7th Edition, John Wiley & Sons, 2004
7. Arthur Beiser, *Concepts of Modern Physics*, 6th Edition, Tata McGraw Hill Publications, 2003

5. Reference Books

1. Arthur Beiser, *Concepts of Modern Physics*, 6th Edition, Tata McGraw Hill Publications, 2003.
2. D. K. Bhattacharya and Poonam Tandon, *Engineering Physics*, Oxford University Press, 2015.
3. Md. N. Khan and S. Panigrahi, *Principles of Engineering Physics 1 & 2*, Cambridge University Press, 2016.
4. G. Aruldhas, *Engineering Physics*, PHI Pvt. Ltd., 2015.
5. Ajoy Ghatak, *Optics*, 6th Edition, Mc Graw Hill Education, 2017.
6. T. Pradeep, *Nano: The Essentials*, McGraw Hill India Ltd, 2007.
7. Halliday, Resnick and Walker, *Fundamentals of Physics*, John Wiley & Sons. Inc, 2001.
8. David J Griffiths, *Introduction to Electrodynamics*, 3rd Edition, Addison-Wesley publishing, 1999.

6. Course Outcomes

After the completion of the course the student will be able to

CO1: Compute the quantitative aspects of waves and oscillations in engineering systems. Identify appropriate seed idea for entrepreneurial realization.

CO2: Apply the interaction of light with matter through interference, diffraction and identify these phenomena in different natural optical processes and optical instruments. Identify appropriate seed idea for entrepreneurial realization.

CO3: Analyze the behavior of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices. Identify appropriate seed idea for entrepreneurial realization.

CO4: Apply the knowledge of magnetism and electromagnetic theory to magnetic materials and devices and to understand the basic concepts of solid-state physics used for the development of nanodevices. Identify appropriate seed idea for entrepreneurial realization.

CO5: Analyze the principles behind various superconducting applications; explain the working of solid-state lighting devices and fibre optic communication system. Identify appropriate seed idea for entrepreneurial realization.

7. Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1				1	1	1	1		1
CO2	3	2	1				1	1	1	1		1
CO3	3	2	1				1	1	1	1		1
CO4	3	2	1				1	1	1	1		1
CO5	3	2	1				1	1	1	1		1

8. Assessment Pattern

Learning Objectives	**Continuous Internal Evaluation (CIE)**		**End Semester Examination (ESE out of 100)**
	Internal Examination 1 (50)	**Internal Examination 2 (50)**	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			
Create			

9. Mark Distribution

Total	CIE				ESE
	Attendance	Internal Examination	Assignment/Quiz/ Course Project	Total	
150	10	25(Average of two scores)	15	50	100

10. End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

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