COURSE CODE	COURSE NAME	L	T	P	CREDIT	YEAR OF INTRODUCTION
101902/PH900B	ENGINEERING PHYSICS B	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 to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes.

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: Fluid Dynamics and Ultrasonics

Streamline and turbulent flow- Equation of continuity of fluid flow- Fluid Energy-Potential, Kinetic, pressure- Equations of fluid dynamics: Differential equations of mass, energy and momentum (Euler's equation-No derivation)- Bernoulli's equation and applications- Magnus effect, airfoil-Navier-Stokes equations (without proof) in cartesian co-ordinates- Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator–Working, Detection of ultrasonic waves - Thermal and Piezoelectric methods. Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid, Applications of ultrasonic waves -SONAR, NDT and Medical.

Module 5: Laser and Fiber Optics

Properties of laser, Absorption and emission of radiation- Spontaneous and stimulated emission- Einstein's coefficients (no derivation)- Population inversion- Metastable states-basic components of laser, Active medium, pumping mechanism, Optical resonant cavity-working principle- Construction and working of Ruby laser and Helium neon laser, Construction and working of semiconductor laser (Qualitative)- Applications of laser. Holography, Difference between hologram and photograph, recording of hologram and reconstruction of image- Applications- Optic Fibre-Principle of propagation of light-Types of fibers-Step index and Graded index fibers- Numerical aperture –Derivation, Fibre optic communication system (block diagram)- Industrial, Medical and Technological applications, 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. John. M. Cimbala and Yunus A. Cengel, *Fluid Mechanics: Fundamentals and Applications,* 4th Edition, SIE, 2019.
4. Robert W. Fox, Alan T. McDonald, Philip J. Pritchard and John W. Mitchell, *Fluid Mechanics*, Wiley India, 2018.

5. Reference Books

1. Arthur Beiser, *Concepts of Modern Physics*, 6th Edition, Tata McGraw Hill Publications, 2003.
2. D. K. Bhattacharya and PoonamTandon, *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. Premlet B., *Advanced Engineering Physics*, 10th Edition, *Phasor Books, 2017.*
9. I. Dominic and A. Nahari, *A Text Book of Engineering physics*, Revised Edition, Owl Books Publishers, 2016.
10. F. M. White, *Fluid Mechanics*, 8th Edition, McGraw Hill Education India Private Limited, 2017.
11. E. Rathakrishnan, *Fluid Mechanics: An Introduction*, 3rd Edition, Prentice Hall India, 2012.

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 ultrasonics in non-destructive testing and use the basic principles of Fluid dynamics to understand Bernoulli's, Euler and Navier-Stokes equations. Identify appropriate seed idea for entrepreneurial realization.

CO5: Apply the comprehended knowledge about LASER and fibre optic communication system in various engineering application. 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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