EVEN SEM - 2021 - 2022

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109

DEPARTMENT OF BASIC SCIENCE

SESSION: 2021-2022 (EVEN SEMESTER)

CO-PO MAPPING

Course Title: Engineering Physics			
Type: Fundamental		Course Code:21PHY22	
No of Hours			
Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total hours/Week	Total teaching hours
4	0	4	40
Marks			
Internal Assessment	Examination	Total	Credits
50	50	100	3

Aim/Objectives of the Course

1. Engineering Physics is one of a basic subject for all engineering course. In this course, principles of Physics are taught to build strong foundation of knowledge required for engineering courses.
2. Learning the basic concepts in Physics which are very much essential in understanding and solving engineering related challenges.
3. Gaining the knowledge of newer concepts in modern physics for the better appreciation of modern technology.

Course Learning Outcomes

After completing the course, the students will be able to

CO1	**Utilizing** the knowledge of simple harmonic motion, derive the expressions for various types of oscillations and to understand the role of shock waves in various fields.	**Applying (K3)**
CO2	**Understand** the principles of lasers, optical fibers and **Applying** its applications in modern technology.	**Applying (K3)**
CO3	**Apply** the theory of modern physics to explain the principles of quantum mechanics, to set up one-dimensional Schrodinger's wave equation and its applications.	**Applying (K3)**
CO4	**Determine** the various electrical and thermal properties of materials like conductors, semiconductors and dielectrics using different theoretical models.	**Applying (K3)**
CO5	**Interpret** the application of sensitive instrumentation for Nano-scale system.	**Applying (K3)**

Syllabus Content

Module 1: Oscillations and Waves Oscillations: Basics of SHM, derivation of equation for SHM, Mechanical simple harmonic oscillators (spring constant by series and parallel combination), Equation of motion for free oscillations, Natural frequency of oscillations. Damped Oscillations: Theory of damped oscillations (derivation), over damping, critical & underdamping (graphical representation), quality factor.	**CO1** 10 hrs PO1-3 PO2-2 PO4-1

Forced Oscillations: Theory of forced oscillations (derivation) and resonance, sharpness of resonance. **Shock waves:** Mach number, Properties of Shock waves, Construction and working of Reddy shock tube, LO: At the end of this module, the students will be able to 1. Explain SHM and different types of oscillations. 2. Derive the expressions for amplitude of damped and forced vibrations. 3. Explain Mach number, classification based on Mach number and Reddy shock tube.	PO6-2 PO7-2 PO12 -1 PSO1-3 PSO2-1

Module 2: **Lasers & Optical Fibers** **Lasers:** Interaction of radiation with matter, Einstein's coefficients (derivation of expression for energy density). Requisites of a Laser system. Conditions for Laser action. Principle, Construction, and working of CO2 and semiconductor Lasers. Application of Lasers in Defence (Laser range finder) and medical applications- Eye surgery and skin treatment. **Optical Fibers:** Propagation mechanism, angle of acceptance, Numerical aperture, Modes of propagation, Types of optical fibers, Attenuation, and Mention of expression for attenuation coefficient. Discussion of a block diagram of point-to-point communication, Optical fiber sensors- Intensity-based displacement sensor and Temperature sensor based on phase modulation, Merits, and demerits, Numerical problems. **LO:** At the end of this module, the students will be able to 1. Derive the expression for energy density in terms of Einstein's Coefficients. 2. Explain the construction and working of different types of lasers and its applications. 3. Explain the mechanism of optical fiber and attenuation. Explain the different types of optical fibers and its applications.	**CO2** 10 hrs PO1-3 PO2-2 PO4-2 PO6-2 PO7-3 PO12-1 PSO1-3 PSO2-1
Module 3: Modern Physics and Quantum Mechanics Introduction to blackbody radiation spectrum- Wien's law, Rayleigh Jean's law, Stefan - Boltzmann law and Planck's law (qualitative), Deduction of Wien's law, and Rayleigh Jeans law from Planck's law. Wave-Particle dualism, de-Broglie hypothesis, de-Broglie wavelength. Heisenberg's uncertainty principle and its physical significance, Application of uncertainty principle (Non-existence of electron in the nucleus), Wave function- Properties, Physical significance, Probability density, Normalization, Eigenvalues and Eigen functions. Time independent Schrödinger wave equation. Particle in a box- Energy Eigenvalues and probability densities, Numerical problems. **LO:** At the end of this module, the students will be able to 1. Explain the blackbody radiation spectrum based on Planck's law. 2. Explain the uncertainty principle and its applications. 3. Obtain the expression for time independent Schrodinger wave equation , energy Eigen values and Eigen functions.	**CO3** 10 hrs. PO1-3 PO2-3 PO4-3 PO6-3 PO7-1 PO12-1 PSO1-3 PSO2-2

Module 4: Electrical Conductivity in Solids **Classical free electron theory**: Free-electron concept, Drude- Lorentz theory & Assumptions. Drift velocity, Mean collision time, Mean free path & Relaxation time (only expression). Expression for electrical conductivity (no derivation), Failures of classical free-electron theory. **Quantum free electron theory**: Assumptions, Density of states (no derivation), Fermi-energy, Fermi factor & its temperature dependence, Fermi - Dirac Statistics, Expression for electrical conductivity (derivation), Merits of Quantum free electron theory. Physics of Semiconductors: Fermi level in intrinsic semiconductors, Expression for the concentration of electrons in the conduction band, Holes concentration in valance band (only mention the expression), Conductivity of semiconductors (derivation), Hall effect, Expression for Hall coefficient (derivation). **Dielectrics:** Electric dipole, Dipole moment, Polarization of dielectric materials, Types of polarization. Qualitative treatment of Internal field in solids for one dimensional infinite array of dipoles (Lorentz field). Claussius-Mossotti equation (derivation), Numerical problems. **LO:** At the end of this module, the students will be able to 1. Explain CFET, QFET, Fermi energy and Fermi Dirac statistics. 2. Derive an expression for electrical conductivity of semiconductors and Hall coefficients. 3. Explain dielectrics, types of polarization and hence arrive Clausius-Mossotti equations.	**CO4** 10hrs PO1-3 PO2-3 PO4-3 PO6-3 PO7-2 PO12-1 PSO1-3 PSO2-2
Module 5: Material Characterization Techniques and Instrumentation Introduction to materials: Nanomaterials and nanocomposites. Principle, construction and working of X-ray Diffractometer, crystal size determination by Scherrer equation, Principle, construction, working and applications of Atomic Force Microscopy (AFM), Fourier Transform Infrared Spectroscopy (FTIR), Xray Photoelectron Spectroscopy (XPS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning tunneling electron microscopy (STEM). **LO**: At the end of this module, the students will be able to 1. Explain nanomaterials and nanocomposites. 2. Determine crystal size using Scherrer equation. 3. Explain the construction and working of various nanomaterial characterization instruments.	**CO5** 10hrs PO1-3 PO2-1 PO4-1 PO6-3 PO7-3 PO12-1 PSO1-3 PSO2-3
Text Books 1. A Text book of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S.Chand & Company Ltd, New Delhi 2. An Introduction to Lasers theory and applications by M.N.Avadhanulu and P.S.Hemne revised edition 2012 . S. Chand and company Ltd -New Delhi. 3. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017 4. Concepts of Modern Physics-Arthur Beiser: 6th Ed;Tata McGraw Hill Edu Pvt Ltd- New Delhi 2006 5. X-ray diffraction- B E Warren published by Courier Corporation. 6. Nano composite materials-Synthesis, properties and applications, CRC Press.	
Reference Books (specify minimum two foreign authors text books) 1. Introduction to Mechanics — M.K. Verma: 2nd Ed, University Press(India) Pvt Ltd, Hyderabad 2009	

2. Lasers and Non Linear Optics – B.B. Laud, 3rd Ed, New Age International Publishers 2011
3. LASERS Principles, Types and Applications by K.R,Nambiar-New Age International Publishers.
4. Solid State Physics-S O Pillai, 8th Ed- New Age International Publishers-2018
5. Shock waves made simple- Chintoo S Kumar, K Takayama and KPJ Reddy: Willey India Pvt. Ltd.New Delhi2014
6. Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRC Press, First Edition, 2008
7. Characterization of Materials- Mitra P.K . Prentice Hall India Learning Private Limited

Web links and Video Lectures (e-Resources):

- https://www.britannica.com/technology/laser,k
- https://nptel.ac.in/courses/115/102/115102124/
- http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
- https://onlinecourses.nptel.ac.in/noc20_mm14/preview
- W1 Nptel.ac.in
- W2 www.physics.org
- W3 www.physicsclassroom.com
- W4 www.coursera.org

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- http://nptel.ac.in
- https://swayam.gov.in
- https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham

Useful Journals

- Journal of Nature Physics
- Journal of Foundation of Physics
- Journal of Physical Review
- Journal of Applied Physics
- Journal of Classical and Quantum Gravity

Teaching and Learning Methods

1. Lecture class: 40 hours
2. Practical classes: 2 hours

Assessment

Type of test/examination: Written examination

Continuous Internal Evaluation(CIE) : 50 marks (20 marks i.e., Sum of three tests + 20 marks Assignments + 20 marks Assignment activity)

Semester End Exam (SEE): 100 marks (students have to answer all main questions) which will be reduced to 50 Marks.

Test duration: 1 :00 hours

Examination duration: 3 hours

CO / PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO10	PO1 1	PO12	PS O1	PS O2
21PHY12	K-level													
CO1	K3	3	2	-	1	-	2	2	-	-	-	-	1	3	1
CO2	K3	3	3	-	3	-	3	1	-	-	-	-	1	3	2
CO3	K3	3	2	-	2	-	2	3	-	-	-	-	1	3	2
CO4	K3	3	3	-	3	-	3	2	-	-	-	-	1	3	2
CO5	K3	3	1	-	1	-	3	3	-	-	-	-	1	3	3

CO to PO mapping

PO1: Science and engineering Knowledge **PO2:** Problem Analysis **PO3:** Design & Development **PO4:**Investigations of Complex Problems **PO5:** Modern Tool Usage **PO6:** Engineer & Society	**PO7:** Environment and Society **PO8:** Ethics **PO9:** Individual & Team Work **PO10:** Communication **PO11:** Project Mngmt & Finance **PO12:** Life long Learning

PSO1: Ability to understand the basic principles, laws, theories and problem solving skills of Engineering Physics and their application in engineering and technology.

PSO2: Ability to apply the concepts of physics to design a process to address the real world challenges.

Course In charge

Head of the Department

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