Department of Physics

About the department

Physics department is one of the oldest departments of PES College of Engineering, Mandya, established in the year 1962. It is located in the first floor of the Administrative Block. The department has very good infrastructure with a carpet area of 320 sq.m consisting of two spacious laboratories, HOD's chamber, two staff rooms, a departmental library, an internet room and a store room. The entire department is newly renovated with modern amenities and the laboratories are well established with latest & modern equipment's. The department offers Engineering Physics Theory and Laboratory courses for the First year B.E students of all branches. The Department has been getting excellent results both in theory and practical examinations.

The department has five faculty, out of which one Professor, one Associate Professor and three Assistant Professors, among them two faculties have Ph.D. in different fields. The department is recognized for research in Physics under PET research center affiliated to University of Mysore, Mysore and VTU Belagavi. Dr. Shivalinge Gowda, Dr. T. S. Shashikumar are involved in research activities and Mr. B.M. Thammanna is pursuing Ph.D.

The department has good supporting Non-teaching staffs with one Assistant Instructor and three Helpers. There is good synergy between the teaching and non-teaching faculty.

Vision:

Department of excellence imparting strong foundation in Applied Physics for developing competent technocrats.

Mission:

Committed to:

1) Develop competent and committed faculty in the light of outcome based education.
2) Motivate and encourage the students to gain scientific temperament and creativity through interactions among faculty and students.
3) Provide strong theoretical foundation complemented with extensive practical training to achieve excellence.

Short Term Goals:

- ☆ Academic performance excellence in basic sciences
- ☆ Guest lecturers/seminars from eminent faculty
- ☆ Faculty development programmes
- ☆ Project proposals and fund raising

Mid Term Goals:

- Modernization of Physics labs
- Conducting National conferences
- Establishment of research centre

Long Term Goals:

- ♦ Inter disciplinary research activities
- ♦ Establishing centre of excellence

Course Title: Engineering Physics			
Course Code: P18PH12/22	**Sem: I/II**	**L-T-P-H: 4 - 0 - 0-4**	**Credits: 4**
Contact Period: Lecture: 52 Hr, Exam: 3 Hrs.	**Weightage: CIE: 50%; SEE: 50% Marks**		

The student should have acquire knowledge of Basic laws, principles, theories, phenomenon, definitions, expressions, applications, advanced research information and techniques required to work with materials and material sciences. Engineering Physics combines basic engineering classes with fundamental physics courses. The course provides a more thorough founding in applied physics of an area related to engineering filed chosen by the student.

Course Content

Unit – I: Modern Physics and Quantum Mechanics: 10 hrs

Modern Physics - Black body radiation spectrum. Statements of Wien's law, Rayleigh-Jean's law, Stefan-Boltzmann's law and Planck's law (Qualitative). Wave-Particle duality, deBroglie concept of matter waves and their characteristic properties, definitions of Phase velocity, group velocity and Particle velocity; Relation between them. Expression for deBroglie wavelength using group velocity concept. *Quantum Mechanics* - Heisenberg's uncertainty principle and its applications (Non-existence of electrons in the nucleus). Wave function, properties, Physical significance of wave function and Normalization. Time-independent one dimensional Schrodinger's wave equation. Eigen functions and Eigen values. Applications of Schrodinger wave equation: 1. Free Particle and 2. Particle in one dimensional potential well of infinite height and finite width. Numerical Problems.

Self study component: Reduction of Rayleigh-Jeans law and Wein's law from Planck's law.

Unit – II: Elastic and Dielectric properties of Materials: 10 hrs

Elastic properties of Materials - Concept of stress, strain, tensile stress, shear stress, compressive stress, concept of elasticity, plasticity, strain hardening and strain softening, Hooke's law, different elastic moduli: Poisson's ratio and its limits. Expression for bending moment of a beam with rectangular cross section. Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of α and β (Mention the expressions). Relation between Y, n, K and σ; Applications: I-shaped girders and Twisting Couple. *Dielectric properties of Materials* - Electric dipole, dipole moment, Dielectric constant and polarization of dielectric materials. Four types of polarization. Polar and non-polar dielectrics. Expression for internal fields in solids (one dimension). Expression for Clausius-Mossotti equation. Mention of solid, liquid and gaseous dielectrics with one example each. Applications of dielectrics in transformers. Numerical Problems.

Self-study component: Rigidity modulus by torsional pendulum

Unit – III: Electrical Conductivity in Metals and Semiconductors: 10 hrs

Electrical Conductivity in Metals - Failures of classical free electron theory. Quantum free electron theory – Assumptions, Fermi Dirac Statistics (qualitative), Fermi level, Fermi temperature, Fermi velocity and Fermi factor. Variation of Fermi factor with Energy and temperature, Expression for density of states. Expression for Fermi energy. Merits of quantum free-electron theory. *Semiconductors* - Classification of Semiconductors, Fermi level in intrinsic and extrinsic semiconductors. Expression for electron concentration in conduction band and Mention the expression for hole concentration in valance band of an intrinsic semiconductor. Relation between E_F and E_g. Expression for intrinsic carrier concentration and conductivity of an intrinsic semiconductor. Numerical Problems.

Self-study component: Expression for energy gap of an intrinsic semiconductor by variation of resistivity with temperature.

Unit – IV: Lasers and Optical Fibers: 10 hrs

Lasers - Review of absorption, spontaneous and stimulated emission of radiation, Expression for energy density in terms of Einstein coefficients. Requisites of a Laser system: laser cavity, active medium and excitation source. Conditions for laser action: metastable state, population inversion and pumping process. Principle, Construction and Working of CO_2 and Semiconductor Lasers. Application of Lasers in range finder, data storage, welding and cutting. *Optical fibers* - Propagation mechanism. Expression for angle of acceptance and Numerical aperture. Fractional index change, V number and number of modes. Types of optical fibers. Attenuation: Causes of attenuation. Expression for attenuation coefficient. Application of optical fibers in communication system. Numerical problems.

Self-study component: Measurement of pollutants in the atmosphere using LASER.

Unit – V: Superconductivity and Theory of Sound: 10 hrs

Superconductivity - Temperature dependence of resistivity in superconductors. Meissner's effect, BCS theory. Types of Superconductors (Type-I and Type-II). High temperature superconductors. Applications of superconductivity – i) Superconducting magnets, ii) Maglev vehicle and iii) SQUIDS. *Theory of Sound : Vibrations* – Definitions for free, damped and forced vibrations, Theory of damped vibrations: overdamping, critical and under damping, quality factor. Resonance and Sharpness of resonance. *Acoustics* - Absorption, reverberation and time of reverberation, Sabine's formula (Mention the expression), Basic requirements of the acoustically auditorium. *Ultrasonics* - Non-destructive method of testing the materials. Measurement of ultrasonic velocity in solids and liquids. Applications of ultrasonics. Numerical Problems.

Self-study component: Sound absorbing materials and factors affecting acoustics of buildings.

Text Books

1. John Wiley & Sons: Engineering Physics - Wiley India Pvt. Ltd, New Delhi.
2. R.K. Gaur, S. L. Gupta ; Engineering Physics – Dhanpat Rai Publications; 2011 Edition

References

1. S. O. Pillai : Solid State Physics, (New Revised Sixth Edition) – New Age International (P) Limited, Publishers, New Delhi.
2. N.H. Ayachit, P. K. Mittal: Engineering Physics – I. K. International Publishing House Pvt. Ltd. New Delhi.
3. M.N. Avadhanulu and P.G. Kshirsagar; Engineering Physics – S Chand & Company Ltd., Ram Nagar, New Delhi.
4. D. R. Khanna, R. S. Bedi : A Text Book of Sound – Published by Atma Ram & Sons – 1981.

D. Course Outcomes (COs)

At the end of the course, the students should be able to:

CO1 - **Understand** the **basic concepts** and **principles** of Physics describing the phenomena associated with Engineering field.

CO2 - **Explain/Describe** the **properties** of various materials, light and sound related to **Engineering applications**.

CO3 - **Formulate/Derive** the **Expressions** for the concepts of Physics pertaining to Engineering field**.**

CO4 - **Apply** the **knowledge** of Physics to **analyze/solve** the numerical problems allied to Engineering field.