भौतिकी विभाग
मोतीलाल नेहरू राष्ट्रीय प्रौद्योगिकी संस्थान इलाहाबाद
प्रयागराज–211004 (भारत)

Department of Physics
Motilal Nehru National Institute of Technology Allahabad
Prayagraj - 211004 (India)

Syllabus
for
Course Name: Engineering Physics - I

Program	**:**	B.Tech.
Year	**:**	First
Branch	**:**	Civil Engineering, Electrical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Chemical Engineering, Department of Applied Mechanics
Course Code	**:**	PHN11501 (Ist Semester) or PHN12501 (IInd Semester)
L:T:P = 2:1:2		**Credit:** 4

Electrodynamics
Gradient, Divergence and Curl operations. Spherical and Cylindrical Coordinates. Gauss divergence theorem and Stoke's theorem. Poisson's and Laplace equations. Working of Helmholtz galvanometer. Magnetic vector potential. Displacement current. Maxwell's equations (integral and differential forms) in free space, Propagation of electromagnetic waves in free space.

Quantum Mechanics
Wave particle duality. Wave packets. Phase and group velocity. Heisenberg's uncertainty principle and its applications. Wave function and its physical interpretation. Probabilities and Normalization. Time independent and dependent Schrödinger wave equation and its simple applications.

Solid State Physics
Crystal structure. Space lattice. Unit cell. Miller indices. Interplanar spacing. X-ray diffraction and Bragg's law. Diamagnetism, Paramagnetism and Ferromagnetism. Hysteresis curve. Curie-Weiss Law.

PRACTICAL: List of Experiments

1. To measure height of a building using Sextant.
2. To measure co-efficient of thermal conductivity of rubber by Lee's disc method.
3. To study variation of magnetic field along the axis of a current carrying coil.
4. Magnetic field distribution due to Helmholtz coil setup.
5. To determine resistivity by four probe method.
6. To measure surface tension using the "break-away" method.
7. To determine specific heat of copper, lead and glass.

Text/Reference Books

1. D, J. Griffths, *Introduction to Electrodynamics*, Prentice Hall of India.
2. S. Gasiorowicz, *Quantum Physics*, John Wiley & Sons.
3. R. Eisbergand R. Resnik, *Quantum Physics*, John Wiley & Sons.
4. A. Beiser, *Concepts of Modern Physics*, Tata McGraw-Hill.
5. Charles Kittel, *Introduction to Solid State Physics*, Wiley India Edition.

Course outcomes from the course

CO-1 The course provides the basics of electromagnetism and electrodynamics required by all branches of engineering professionals for the development of advanced technology.

CO-2 The course provides a basic understanding of quantum mechanics to address engineering-based problems at the molecular level required for all branches of engineering professionals for the development of advanced technologies and electronic devices.

CO-3 The course provides a basic understanding of solid-state physics to address engineering-based problems. It also helps in the development of new materials.

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Syllabus
for
Course Name: Engineering Physics - II

Program	**:**	B.Tech.
Year	**:**	First
Branch	**:**	Mechanical Engineering, Production and Industrial Engineering
Course Code	**:**	PHN11502 (Ist Semester) or PHN12502 (IInd Semester)
L:T:P = 2:1:2		**Credit:** 4

Physical Optics
Interference: Condition of observing interference, Fresnel's Biprism. Stoke's treatment. Interference in thin films. Newton's rings.

Diffraction: Fraunhofer's diffraction - Single slit, Double slit and N-slit or plane transmission grating. Rayleigh's criterion of resolution. Resolving power of grating and telescope.

Polarisation: Polarisation by reflection. Double refraction. Half wave and quarter wave plates. Production and analysis of plane, elliptical and circularly polarised light. Optical activity. Specific rotation. Laurent half shade polarimeter.

Laser
Characteristics of Laser light, Stimulated and spontaneous emission. Population inversion. Einstein's coefficients. Laser emission, Nd-YAG and He-Ne lasers. Applications of laser in engineering.

Special Theory of Relativity
Frame of reference. Inertial and non-inertial frames. Postulates of special theory of relativity, Lorentz transformation of space and time, Length contraction, Time dilation, Addition of velocities, Energy Mass equivalence.

PRACTICAL: List of Experiments

1. To measure height of a building using Sextant.
2. Interference of light: Newton's ring.
3. Interference of light: Fresnel's Biprism.
4. Diffraction by a plane transmission grating.
5. Specific rotation of sugar using Polarimeter,
6. Resolving power of a telescope.
7. Surface tension measurement.
8. Variation of magnetic field along the axis of a current carrying coil.
9. Magnetic field distribution due to Helmholtz coil setup.

Text/Reference Books

1. R. Resnik, *Introduction to Special Relativity*, John Wiley & Sons, Inc (2005).
2. A. Ghatak, *Optics,* Tata McGraw-Hill, (2008).
3. E. Hecht, *Optics*, Addison-Wesley (2002).
4. A. Beiser, Concepts of Modern Physics, Tata McGraw-Hill, (2005).
5. B. B. Laud, *Lasers and Non-Linear Optics*, Wiley, (2003)

Course outcomes from the course

CO-1 Basics of optics are introduced to understand many related technologies e.g., interference, polarization and diffraction, etc.

CO-2 Laser is a powerful tool and is used in several applications relevant to mechanical and production engineers. Fundamentals of lasers are introduced to explain the working and use of lasers.

CO-3 Make students familiar with the unexpected outcomes in the regime of extremely high-speed objects. The topic is introduced to help them understand many technical objects and phenomena such as GPS technology, the physics of astronomical objects, etc.

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Syllabus
for
Course Name: Engineering Physics - III

Program : B.Tech.
Year : First
Branch : Biotechnology
Course Code : PHN11503 (Ist Semester) or PHN12503 (IInd Semester)
L:T:P = 2:1:2 **Credit:** 4

Thermodynamics
Concept of heat. Laws of thermodynamics. Entropy. adiabatic isothermal and isobaric process. Carnot cycle and its efficiency. Refrigerator. Clausius-Clapeyron's equation. Latent heat. Specific heat of solids and gases. Thermal conductivity. Maxwell's equations

Solid State Physics
Crystal structure. Space lattice. Unit cell. Miller indices. Interplanar spacing. Characteristic and Continuous. X-ray spectra. Mosley's law, X-ray diffraction and Bragg's law.

Diamagnetism. Paramagnetism. Ferromagnetism. Hysteresis curve. Curie-Weiss Law.

Semiconductors: intrinsic and extrinsic semiconductors, p-type and n-type semiconductors, p-n junction

Acoustics
Production and detection of ultrasonic waves. Velocity of ultrasonics in liquids and gases. Applications of ultrasonic waves. Acoustics of buildings. Reverberation. Absorption coefficient. Sabines's formula for reverberation time.

Practical: List of Experiments
1. To measure height of a building using Sextant.
2. To measure Coefficient of thermal conductivity of rubber by Lee's disc method.
3. To study variation of magnetic field along the axis of a current carrying coil.
4. Magnetic field distribution due to Helmholtz coil setup.
5. To determine resistivity by four probe method.
6. To measure surface tension using the "break-away" method.
7. To determine specific heat of copper, lead and glass.

Text/Reference Books

1. M.W. Zemansky, Richard Dittman, Heat and Thermodynamics, McGraw-Hill.

2. Brij Lal and Subramaniam, Heat Thermodynamics & Statistical Physics, S. Chand.
3. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition.
4. B. Ghosh, Principles ° of Acoustics, Sreedhar Publishers.

Course outcomes from the course

CO-1 To introduce concepts of thermodynamics required for engineering applications.

CO-2 To provide an understanding of solid-state physics to address the engineering-based problems.

CO-3 To introduce the phenomenon and applications of ultrasonics as well as acoustics of buildings.