I B.Tech Physics Syllabus (from 2013)

PH101 PHYSICS I
(Common to all branches)

Objectives

To make a bridge between the physics in school and engineering courses.

To introduce the basic concepts of modern science like Photonics, Engineering applications of acoustics, fundamentals of crystal physics and materials science.

Lasers

Introduction to Laser-characteristics of Lasers-Spontaneous and stimulated emissions – Einstein's coefficients – population inversion and lasing action – laser systems: Ruby laser, He-Ne Laser, semiconductor laser-applications:–Holography- CD-drive – industrial and medical applications.

Fiber Optics

Fermat's principle and Snell's law-optical fiber – principle and construction – acceptance cone - numerical aperture – V-Number - types of fibers, Fabrication: Double Crucible Technique, Vapour phase Oxidation Process – fiber optic communication principle – fiber optic sensors-other applications of optical fibers.

Acoustics

Characteristics of musical sound – loudness – Weber-Fechner law – decibel – absorption coefficient – reverberation – reverberation time – Sabine's formula – acoustics of buildings – ultrasonics – production of ultrasonics using piezoelectric method –magnetostriction method-applications.

Crystallography

Crystalline and amorphous solids – lattice and unit cell – seven crystal system and Bravais lattices – symmetry operation – Miller indices – atomic radius – coordination number – packing factor calculation for sc, bcc, fcc – Bragg's law of X-ray diffraction –Laue Method- powder crystal method.

Magnetic materials, conductors and superconductors

Magnetic materials: Definition of terms – classification of magnetic materials and properties – domain theory of ferromagnetism- hard and soft magnetic materials – applications.

Conductors: classical free electron theory (Lorentz –Drude theory) – electrical conductivity

Superconductors: definition – Meissner effect – type I & II superconductors – BCS theory (qualitative) – high temperature superconductors – Josephson effect – quantum interference (qualitative) – SQUID – applications.

Outcome

The student will be able to understand many modern devices and technologies based on lasers and optical fibers. Student can also appreciate various material properties which are used in engineering applications and devices.

Text Books

1. A text book of Engineering Physics, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, New Delhi (2009).

2. Engineering Physics, R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8th edn., New Delhi (2001).

Reference Books

1. Laser Fundamentals, William T. Silfvast, 2nd edn, Cambridge University press, New York (2004)

2. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York (2001).

3. Introduction to solid state physics,7th Edn, Charls Kittel, Wiley, Delhi (2007)

Laboratory Experiments

1. Torsional pendulum
2. Numerical aperture of an optical fiber
3. Temperature measurement - Thermocouple
4. Specific rotation of a liquid – Half Shade Polarimeter
5. Thickness of a thin wire – Air Wedge
6. Conversion of galvanometer into ammeter and voltmeter

7. Dispersive power of a prism – Spectrometer
8. Superconductivity- measurement of transition temperature
9. Absorption spectrometer
10. Brewster's Angle measurement
11. Measurement of Young's modulus

Reference Books

1. Practical Physics, R.K. Shukla, Anchal Srivastava, New age international (2011)
2. B.Sc. Practical Physics, C.L Arora, S. Chand &Co. (2012)

PH102A PHYSICS II
(Circuit Branches)

Objectives

To make a bridge between the physics in school and engineering courses. To introduce the basic concepts of modern physics like fundamentals of quantum mechanics, nuclear physics and advanced materials.
To introduce fundamental physics like electrodynamics and semiconductor physics for circuit branch students.

Quantum Mechanics

Inadequacy of classical mechanics (black body radiation, photoelectric effect) – wave and particle duality of radiation – de Broglie concept of matter waves – electron diffraction – Heisenberg's uncertainty principle – Schrodinger's wave equation – eigenvalues and eigenfunctions – superposition principle – interpretation of wave function – particle confined in one dimensional infinite square well potential.

Nuclear and Particle Physics

Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half lives - application in determining the age of rock and fossils- Stellar nucleosynthesis. Fundamental forces - Particle physics - classification of matter - quark model - neutrino properties and their detection.

Advanced Materials

Nanomaterials: introduction and properties – synthesis – chemical vapour deposition – ball milling – applications. Carbon nanotubes:

structure and properties – synthesis– arc method – pulsed laser deposition- applications.
Liquid Crystals: types – nematic, cholesteric, smectic – modes: dynamic scattering, twisted nematic – display systems.
Shape memory alloys-one way and two way memory effect-pseudoelasticity-applications.

Electrodynamics

Electrostatics: Coulomb's law - Gauss's law – proof of Gauss's law-Electrostatic filed in matter: dielectric polarization, polarizability and susceptibility - types of polarization – internal field and Claussius-Mosotti equation. Magetostatics: Lorentz force -Steady current and equation of continuity - Biot-Savart law – Ampere's law –Magnetostatic field in matter: torques and forces on magnetic dipoles-Magnetization-Faraday's law of induction – Maxwell's equations: generalization of Ampere's law –– propagation of EM waves in free space.

Semiconductor Physics

Introduction-Direct and indirect band gap semiconductors - Intrinsic semiconductor at 0 K-Intrinsic semiconductor at room temperature-Intrinsic carriers- Electron and Hole concentrations-doping-n-type – p-type-temperature variation of carrier concentration in extrinsic semiconductor-Extrinsic conductivity-Law of Mass action-Charge neutrality-Fermi level in extrinsic semiconductors-Electrical conduction in extrinsic semiconductors-Hall effect.

Expected Out come

The student will be able to understand fundamentals of electrodynamics and semiconductor physics which is base of many modern devices and technologies. Student will also get an exposure to modern physics topics like nuclear physics, nanotechnology and advanced materials.

Text Books

1. A text book of Engineering Physics, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, New Delhi (2009).
2. Engineering Physics, R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8th ed., New Delhi (2001).

Reference Books

1. Concepts of Modern Physics. Arthur Beiser, Tata McGraw-Hill, New Delhi (2010).

2. Semiconductor Physics and Devices:Basic principle, Donald A. Neamen 4th ed,, McGraw-Hill, New York (2012)
3. Introduction to Elecrodynamics, David J. Griffiths, 3rd ed, Printice Hall of India, NewDelhi (2012)
4. Introduction to Nanotechnology, C.P. Poole and F.J. Owens, Wiley, New Delhi (2007)
5. *Introduction to Liquid Crystals Chemistry and Physics,* 2nd ed, *Peter J. Collings, Princeton University Press, New Jersey, (2002).*
6. Shape memory alloys-modeling and engineering applications, Ed. D. C. Lagoudas, Springer, New York (2008)

PH102B PHYSICS II
(Non-Circuit Branches)

Objectives

To make a bridge between the physics in school and engineering courses
To introduce the basic concepts of modern physics like fundamentals of quantum mechanics, nuclear physics and advanced materials.
To introduce the concepts of NDT and Vacuum Technology.

Quantum Mechanics Inadequacy of classical mechanics (black body radiation, photoelectric effect) – wave and particle duality of radiation – de Broglie concept of matter waves – electron diffraction – Heisenberg's uncertainty principle – Schrodinger's wave equation – eigenvalues and eigen functions – superposition principle – interpretation of wave function – particle confined in one dimensional infinite square well potential.

Nuclear and Particle Physics Fundamental forces - Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half lives - application in determining the age of rock and fossils- Neutrons and its applications (neutron diffraction, nuclear reaction etc)-Stellar nucleosynthesis. Particle physics - classification of matter - quark model- neutrino properties and their detection.

Advanced Materials *Nanomaterials* - Introduction and properties – synthesis – chemical vapour deposition – ball milling– applications. Carbon nanotubes: structure and properties – synthesis– arc method – pulsed laser deposition- applications.

Liquid Crystal types – nematic, cholesteric, smectic – modes: dynamic scattering, twisted nematic – display systems.
Shape memory alloys-one way and two way memory effect-pseudoelasticity-applications
Non-Destructive Testing Principle of ultrasonic testing – inspection methods – different types of scans – liquid penetrant testing – magnetic particle inspection – principle and types of radiography – exposure factor – attenuation of radiation – real time radiography – principle of thermography – thermographic camera – advantages and limitations of all methods.
Vacuum Technology Introduction-Exhaust pump and their characteristics-different types of pumps-rotary vane pump-roots pump-diffusion pump-turbo-molecular pump-measurement of low pressure-pirani gauge-penning guage - applications of vacuum technology - thin film deposition: thermal evaporation-sputtering.

Expected Outcome
Student will get an exposure to most modern and advanced concepts in nuclear physics, nanotechnology and advanced materials. Study of basic concept of NDT is very important for a modern engineer.

Text Books
1. *A text book of Engineering Physics, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, New Delhi (2009).*
2. Engineering Physics, R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8th ed., New Delhi (2001).

Reference Books
1. Concepts of Modern Physics. Arthur Beiser, Tata McGraw-Hill, New Delhi (2010).
2. Hand Book of Non-destructive evaluation, C.J. Hellier, McGraw-Hill, New York (2001)

3. Vacuum Science and Technology, V.V. Rao, T.B. Ghosh, K.L. Chopra, Allied Publishers, New Delhi (2008)
4. Introduction to Nanotechnology, C.P. Poole and F.J. Owens, Wiley, New Delhi (2007)
5. Introduction to Liquid Crystals Chemistry and Physics, 2nd Ed, *Peter J. Collings, Princeton University Press, New Jersey, (2002).*
6. Shape memory alloys - modeling and engineering applications, Ed. D. C. Lagoudas, Springer, New York (2008)

LABORATORY EXPERIMENTS

1. Wavelength of sodium light – Newton's rings
2. Thermal conductivity –Lee's Disc
3. Wavelength of mercury spectrum – Spectrometer
4. Calibration of Voltmeter – Potentiometer
5. Wavelength of laser using diffraction grating
6. Field along the axis of a Circular coil
7. Non-destructive testing by ultrasonic flaw detector.
8. GM counter experiment
9. Zeeman effect experiment
10. Millikan's oil drop experiment
11. Kunds tube experiment

Reference Books

1. Practical Physics, R.K. Shukla, Anchal Srivastava, New age international (2011)
2. B.Sc. Practical Physics, C.L Arora, S. Chand &Co. (2012)