BSC-101 Physics

1st /2nd Semester **L T P C**
Internal Marks: 40 **3 1 0 4**
External Marks: 60
Total Marks: 100

Course Outcomes

On completion of the course, the student will have the ability to

- Solve the problems in the fields of electromagnetism, lasers and fiber optics.
- Apply the knowledge acquired from the study of semiconductors to identify their use in latest technologies.
- Recognize the inadequacy of classical mechanics for certain physical problems and thus find the solutions of these problems using principles of quantum physics.
- Comprehend the concept of oscillations and hence to implement the same in the theory of machines.
- Understand the basic characteristics of materials relevant to engineering and technological applications.
- Apply multidisciplinary knowledge of science for reviewing complex problems from different angles/perspectives and to find the best possible solution/model.

Detailed Contents:

Part-A

1. **Basics of electromagnetic theory:** Concept of Gradient, Divergence & Curl, Relationship between Electric Field & Potential, Solid angle, Statements of Gauss's and Stoke's theorem, Maxwell's Equations in differential form, EM wave equation in vacuum, Transverse nature and polarization of EM waves, Introduction to Poynting vector. **07 Lectures**

2. **Laser and Fiber optics:** Spontaneous & Stimulated Emissions, Einstein's theory, Components of laser, Classification of Lasers, Ruby Laser, He-Ne Laser, CO_2 Laser, Semiconductor Laser, Applications of Lasers in science, engineering and medicine, Introduction to fibre optics; Acceptance angle and numerical aperture, Step index and graded index optical fibres, V-number and modes of propagation, Loss in optical fibres (Qualitative idea), splicing, coupling and connectorizing, applications of optical fibres. **09 Lectures**

3. **Semiconductors:** Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport, diffusion and drift, p-n junction, Introduction to LED and solar cell. **05 Lectures**

Part- B

4. **Mechanics and mechanics of solids:** Harmonic oscillator, Free, damped and forced oscillators, Impedance matching and resonance, Concept of stress and strain at a point. **05 Lectures**

5. **Quantum Mechanics:** Need of Quantum mechanics, Wave-particle duality, Matter waves, Phase velocity & Group velocity, Significance & normalization of wave function, Eigen functions & Eigen values, Time dependent and independent Schrodinger wave equation, Particle in a box (One Dimensional Case). **05 Lectures**

6. **Physics of materials:** Electronic materials; dielectrics and ferroelectrics, Magnetic materials; dia, para, ferro and ferrimagnetic, Concept of domain theory, Ferrites, B-H curve, Magnetic anisotropy, Magnetostriction, Superconductivity, Meissner effect, Type I & Type II superconductors, London equations, Brief introduction to BCS theory, Applications of superconductivity, Introduction to nanomaterials, Surface to volume ratio, Classification and properties of nanomaterials, Applications, potential and risks of nanomaterials. **09 Lectures**

Text Books

(1) M. N. Avadhanulu, "A Text Book of Engineering Physics", S. Chand Publishers, revised edition, 2014.

(2) Serway & Jewett, "Physics for Scientists & Engineers" (Vol. I & II), Cengage Learning, 6th edition.

(3) M. N. Khan, S. Panigrahi, "Principles of Engineering Physics" (Vol. I & II), Cambridge University Press, 1st edition, 2016.

(4) D. R. Joshi, "Engineering Physics", McGraw Hill, 1st edition, second reprint, 2014.

Reference Books

(1) D. J. Griffiths, "Introduction to Electrodynamics", Prentice Hall of India, 4th edition, 2012.
(2) B. B. Laud, "Lasers & Non-Linear Optics", New Age International Ltd., 3rd edition, 2015.
(3) K. Thyagarajan, A. K. Ghatak, "Lasers: Fundamentals & Applications", Springer, 2nd edition, 2010.
(4) J. C. Palais, "Fibre Optic Communication", Pearson India, 5th edition, 2011.
(5) S. M. Sze, "Semiconductor Devices: Physics & Technology", Wiley, 1985.
(6) Milman and Halkias, "Integrated Circuits", Tata McGraw Hill, 2001.
(7) Ben G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
(8) M. K. Harbola, "Engineering Mechanics", Cengage Learning, 2nd edition, 2013.
(9) M. K. Verma, "Introduction to Mechanics", University Press, 2nd edition, 2016.
(10) S. H. Crandall, N. C. Dhall and T. J. Lardner, "An Introduction to the Mechanics of Solids", McGraw Hill, 2nd edition with SI Units.
(11) E. P. Popov, "Engineering Mechanics of Solids", Pearson Education, 1998.
(12) D. J. Griffiths, "Quantum Mechanics", Pearson Education, 2008.
(13) Richard Robinett, "Quantum Mechanics", OUP, 2006.
(14) B. S. Rajput, "Advanced Quantum mechanics", Pragati Parkashan, 2013.
(15) W. D. Callister, "Material Science & Engineering", John Wiley & Sons, 7th edition, 2007.
(16) D. Wei, "Solid State Physics", Cengage Learning, 1st edition, 2008.
(17) M. Tinkham, "Introduction to Superconductivity", Dover Publications, 2nd edition, 1996.
(18) R. Rakesh, "Nanotechnology", S. Chand Publishers, 2nd edition, 2014.
(19) A. K. Bandyopadhyay, "Nanomaterials", New Age International Ltd., 2nd edition, 2017.
(20) Charles Poole, Frank Owens, "Introduction to Nanotechnology", Wiley, 2007.

Online Resources

(1) Electromagnetism: http://nptel.ac.in/courses/115104088/ [accessed on 24.05.2018]
(2) Lasers: http://nptel.ac.in/courses/104104085/ [accessed on 24.05.2018]
(3) Fiber optics: http://nptel.ac.in/courses/117104127/ [accessed on 24.05.2018]
(4) Semiconductors: http://nptel.ac.in/courses/117103063/ [accessed on 24.05.2018]
(5) Solid mechanics: http://nptel.ac.in/courses/112107147/ [accessed on 24.05.2018]
(6) Quantum mechanics: http://nptel.ac.in/courses/115102023/1 [accessed on 24.05.2018]
(7) Dielectrics: http://nptel.ac.in/courses/115101005/20 [accessed on 24.05.2018]
(8) Ferroelectrics: http://nptel.ac.in/courses/113105015/19 [accessed on 24.05.2018]
(9) Superconductivity: http://www.nptel.ac.in/courses/115101012/ [accessed on 24.05.2018]
(10) Nanotechnology: http://nptel.ac.in/courses/118102003/ [accessed on 24.05.2018]
(11) Khan academy (Free online courses): https://www.khanacademy.org/

BSC-102 Physics Laboratory

1st /2nd Semester **L T P C**
Internal Marks: 30 **0 0 2 1**
External Marks: 20
Total Marks: 50

Course Outcomes

On completion of the course, the student will have the ability to:

- Understand the importance of least count of instruments and errors in measurements and their propagation in the calculated results.
- Compare the quality of different lasers and their applications in different optical processes.
- Find the losses taking place in optical fibers and understand the working of an optical communication system.
- Control the motion of charged particle in external electric and magnetic fields and use this property for analyzing different ac and dc circuits.
- Understand the minute details of optical phenomena like interference, diffraction and polarization.
- Study properties of different electric and magnetic materials viz.; dielectric constant, polarizability, change in dimensions in external electric and magnetic fields, resistivity and energy gap in semiconductors.

Detailed Contents:

1. Basic knowledge of least count and error analysis (Vernier calipers and Screw gauze).
2. To find the divergence of given Laser.
3. To study diffraction using Laser beam and hence determine the wavelength of Laser beam.
4. To determine thickness of a glass plate using Michelson's Interferometer.
5. To determine the numerical aperture of an optical fiber.
6. To study the losses in an optical fiber.
7. To find the value of Planck's constant and photoelectric work function of the material of cathode using a solar cell.
8. To obtain the waveform of a given oscillator/A.C. Mains using CRO.
9. To study B-H curve using CRO.
10. To find the velocity of ultrasonic waves in a given liquid.
11. To find the dielectric constant of a substance.
12. Introduction to spectrometer and its use to find the angle of prism.

13. To find resistivity and energy gap of a semiconductor using four probe method.
14. To study the rotation of plane of polarization of plane polarized light using sugar solution.

Note: Each student is required to perform at least Eight experiments from 1-14 and first experiment is compulsory.

Suggested Books:

1. C L Arora, "Practical Physics", S. Chand & Co., 2010.
2. R S Sirohi, "Practical Physics", Wiley Eastern.
3. Harnam Singh, P. S. Hemne , "Practical Physics", S. Chand & Co., 4th edition.