|  |  |  |  |
| --- | --- | --- | --- |
| **BSC-102** | **Optics and Modern Physics** | **3L:0T:0P (3 Hrs)** | **3 Credits** |

**Pre-requisites:** Mathematics course with integral and differential calculus.

**Course Objectives:** To impart knowledge in basic concepts of physics relevant to technological applications, and apply laws of physics to real world problems.

|  |
| --- |
| **Course Content:** |
| **Module I: Quantum Physics (10 Hours)** |
| Basics of units and dimension, Dimensional analysis, Systems of units, Introduction to Quantum mechanics, Dual nature of matter, Compton effect, Properties of wave function, phase and group velocities, Heisenberg’s uncertainty principle with its elementary proof and applications, Derive energy and momentum operators, Time dependent and independent Schrodinger equation, Particle in one dimensional box. |
| **Module II: Wave Optics (10 Hours)** |
| Interference of light, Young’s double slit experiment, Newton’s rings, Fraunhoffer diffraction from single slit and N-Slit diffraction grating, Concept of Polarization, Brewster’s law, Double refraction, Nicol prism, uses of Polaroid. |
| **Module III: Theory of Semiconductors and Superconductors (10 Hours)** |
| Band theory of solids, density of states, Fermi Dirac distribution function, Fermi level in intrinsic and extrinsic semiconductor, construction and working of Zener diode and Solar Cell, Hall Effect, Introduction to superconductivity, persistent currents, Meissner effect, Type-I and Type-II superconductors |
| **Module IV: Lasers (10 Hours)** |
| Properties of laser beams, Einstein’s theory of matter radiation interaction and A and B coefficients, explain conditions to achieve lasing action, basic parts of a laser, different types of lasers, gas laser (He-Ne and CO2), solid state laser (Ruby, Neodymium), applications of lasers. |
| **Module V: (a) Fiber Optics (5 Hours)** |
| Introduction to optical fibers, calculation of acceptance angle, acceptance cone, numerical aperture, V-number, No. of Modes and attenuation in optical fibers, explain types of optical fibers, losses in fiber, and applications of optical fibers. |
| **(b)** **Nuclear Physics ((5 Hours)**  Basic properties of nuclear physics, The liquid drop model, Linear Accelerator (LINAC), Cyclotron, |

# Course Outcomes:

**CO1:** To **e**xplain fundamentals of units and quantum mechanics, and apply to phase velocity, group velocity, and particle in one dimensional box.

**CO2:** To analyze the intensity variation of light due to polarization, interference and diffraction, and derive intensity expression in single slit, N-slit diffraction grating. Calculate radius of curvature of lens in using Newton’s ring experiment.

**CO3:** To explain theory of semiconductors and superconductors and apply to Solar cells, Zener diode, Hall Effect and Meissner effect.

**CO4:** To drive relation between Einstein’s A’s and B’s coefficients, and explain working principle of different types of lasers.

**CO5:** To state the principle of optical fiber and calculate acceptance angle, numerical aperture, V-number, No. of modes, Understanding basic properties of nucleus and applies to LINIAC and cyclotron accelerators.

# Textbooks/ References

* 1. Gaur and Gupta, Engineering Physics, Dhanpat Rai Publications.
  2. H. K. Malik and A. K. Singh, Engineering Physics, Mc Graw Hill Education.
  3. Dr. S. L. Gupta and Sanjeev Gupta, Engineering Physics, Dhanpat Rai Publications
  4. Navneet Gupta, Engineering Physics, Dhanpat Rai Publications
  5. Dr. R. Dogra, Engineering Physics, Katson Books
  6. C. Kittel , Introduction to solid state physics, Wiley
  7. Beiser, Concepts of Modern Physics, TMH
  8. R. P. Goyal, Unified Physics, Shivlal agarwala & Co.
  9. K. Thyagarajan, Ajoy Ghatak, Lasers: Fundamentals and Applications, Springer Science and Business Media.
  10. O. Svelto, Principles of Lasers, Springer
  11. Cohen, Nuclear physics, Mc Graw Hill Publications
  12. Shatendra K. Sharma, Atomic and Nuclear Physics, Pearson

13. Ajay Ghatak and K. Thyagrajan, Introduction To Fiber Optics, Cambridge University Press (1 January 2017)

|  |  |  |  |
| --- | --- | --- | --- |
| **LC-BSC-102** | **Optics and Modern Physics** | **0L:0T:1P (2 Hrs)** | **1 Credits** |

|  |  |
| --- | --- |
| **List of Experiment** | |
| 1. | To determine wavelength of given laser light source. |
| 2 | To determine the radius of curvature of given plano convex lens with the help of a plane  Newton’s ring experiment. |
| 3. | To determine the wavelength of main spectral lines of given mercury light with help of a  transmission grating. |
| 4. | To determine refractive index and dispersive power of the material of given prism using  spectrometer. |
| 5. | To plot forward and reverse characteristics curve of P-N junction diode. |
| 6. | To determine the divergence of He-Ne Laser. |
| 7. | To find numerical aperture of a given optic fibre and hence to find its acceptance angle. |
| 8. | To verify Brewster’s law using polarizer. |
| 9. | To determine the Hall voltage and charge carrier density, in semiconductor using Hall  effect experiment. |
| 10. | To plot forward and reverse characteristics curve of Zener diode. |

# Course Outcomes:

**CO1:** To **e**xplain fundamentals of units and quantum mechanics, and apply to phase velocity, group velocity, and particle in one dimensional box.

**CO2:** To derive intensity expression in single slit, N-slit diffraction grating. Calculate radius of curvature of lens in using Newton’s ring experiment.

**CO3:** To explain theory of semiconductors and superconductors and apply to Solar cells, Zener diode, Hall Effect and Meissner effect.

**CO4:** To drive relation between Einstein’s A’s and B’s coefficients, and explain working principle of different types of lasers.

**CO5:** To state the principle of optical fiber and calculate acceptance angle, numerical aperture, V-number, No. of modes, apply to fiber optic communication system.