| Course Code | Course Name | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Pract. | Tut. | Theory | Pract. | Tut. | Total |
| BSC102 | Applied Physics | 2 | -- | - | 2 | -- | - | 2 |

| Course Code | Course Name | Theory | | | | | Term work | Pract / Oral | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment Test (IAT) | | | End Sem Exam | Exam Duration (in Hrs) | | | |
| | | IAT-I | IAT-II | IAT-I + IAT-II (Total) | | | | | |
| BSC102 | Applied Physics | 15 | 15 | 30 | 45 | 02 | -- | -- | 75 |

**Rationale:**

Most of the engineering branches are being off-spring of basic sciences where physics is playing a pivotal role in concept and understanding of foundation of core engineering branches. This syllabus is developed by keeping in mind, needs of all branches that we offer in University of Mumbai. In the distribution of modules, core physics and its applied form are given priority. Further, it is ensured that these modules will cover prerequisites needed for engineering courses to be introduced in higher semesters as core subjects or as interdisciplinary subjects in respective branches.

**Course Objectives:**

1. To provide students with a basic understanding of laser operation.
2. To explain the basic working principle of Optical fiber and its use in communication technology.
3. To demonstrate principles of interference in thin film.
4. To describe Maxwell's equations and their significance.
5. To build a foundation of quantum mechanics needed for modern technology.
6. To give exposure to the concept of Fermi level in semiconductors.

**Course Outcomes:**

1. Learners will be able to ILLUSTRATE the use of laser in LiDAR and Barcode reading.
2. Learners will be able to APPLY the foundation of fiber optics in the development of modern communication technology
3. Learners will be able to determine the wavelength of light and refractive index of liquid using the interference phenomenon.

4. Learners will be able to ARTICULATE the significance of Maxwell's equations.
5. Learners will be able to RELATE the foundations of quantum mechanics with the development of modern technology.
6. Learner will be able to CLASSIFY semiconductors and EXPLAIN variation of Fermi level with temperature and doping concentration.

**DETAILED SYLLABUS:**

| | Name of Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| | **Prerequisite** | Basic knowledge of optics and atomic structure, Wavefront and Huygens principle, reflection and refraction, Interference by division of wavefront, Refractive index of a material, Snell's law, Basics of vector algebra, partial differentiation concepts, Dual nature of radiation, Photoelectric effect, Matter waves, Davisson-Germer experiment. Intrinsic and extrinsic semiconductors, electrical resistivity and conductivity concepts | -- | -- |
| I | **Lasers** | Lasers: Spontaneous and stimulated emission, population inversion, pumping, active medium & active center, resonant cavity, coherence length and coherence time, Characteristics of lasers, He-Ne laser: construction and working. Fiber laser Construction and working Application : (i)Elementary knowledge of LiDAR(ii) Barcode reader (iii) Application of laser in metal work | **04** | **CO1** |
| II | **Fibre Optics** | Optical fibers: Critical angle, acceptance angle, acceptance cone, numerical aperture, total internal reflection andpropagation of light, Types of optical fibers: Single mode & multimode, step index & graded index, attenuation,attenuation coefficient, factors affecting attenuation, Fibre Optic Communication System, Advantages of optical fiber | **04** | **CO2** |

| | | | | |
|---|---|---|---|---|
| | | communication, numerical | | |
| III | **Interfenence In Thin Films** | Interference in thin film of uniform thickness, conditions of maxima and minima for reflected system, Conditions for maxima and minima for wedge shaped film (qualitative), engineering applications –<br>(i) Newton's rings for determination of unknown monochromatic wavelength and refractive Index of transparent liquid (ii) AntiReflecting Coating | **04** | **CO3** |
| IV | **Electrodynamics** | Vector Calculus : Gradient, Divergence, Curl. Gauss's law, Amperes' circuital Law, Faraday's law, Divergence theorem , Stokes theorem Maxwell's equations in point form, Integral form and their significance(Cartesian coordinate only) | **04** | **CO4** |
| V | **Quantum Physics** | de Broglie hypothesis of matter waves, de Broglie wavelength for electron, Properties of matter waves, Wave function and probability density, mathematicalconditions for wave function, problems on de Broglie wavelength, Need and significance of Schrödinger'sequations, Schrödinger's time independent and time dependent equations, Energy of a particle enclosed in a rigidbox and related numerical problems, Quantum mechanical tunneling, Principles of quantum computing: concept of Qubit. | **06** | **CO5** |
| VI | **Basics Of Semiconductor Physics** | Direct and Indirect Band Gap Semiconductors, Electrical Conductivity of Semiconductors, Drift Velocity, Mobility and Conductivity in Conductors Fermi- Dirac distribution function, Position of Fermi Level in Intrinsic and Extrinsic Semiconductors. | **04** | **CO6** |

**Text Books:**


1. A Text book of Engineering Physics -Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar, S. Chand, Revised Edition 2014
2. Modern Engineering Physics - A. S. Vasudeva, S. Chand, Revised Edition 2013
3. Engineering Physics D. K Bhattacharya,PoonamTandon, Oxford Higher Education, 1st Edition 2015

4. Engineering Physics -R. K. Gaur,S. L. Gupta, DhanpatRai Publications, 2012
5. Engineering Physics -V. Rajendran, McGraw Hill Educations, 2017
6. A Textbook of Nanoscience and Nanotechnology, T. Pradeep Tata McGraw Hill Education Pvt. Ltd., 2012

**References:**

1. Concepts of Modern Physics - ArtherBeiser, ShobhitMahajan, S. Choudhury, McGraw Hill, 7thEdition 2017
2. Fundamentals of optics - Francis A. Jenkins, Harvey E. White, McGraw Hill Publication, India, 4th Edition
3. Fundamentals of Physics, Halliday and Resnick, Wiley publication
4. Introduction to Electrodynamics, D. J. Griffiths, Pearson PublicationOnline

**References:**

| Sr. No. | Website Name |
|---|---|
| 1. | https://archive.nptel.ac.in/courses/115/102/115102124/ |
| 2. | https://archive.nptel.ac.in/courses/115/102/115102025/ |
| 3. | https://archive.nptel.ac.in/courses/115/105/115105132/ |

**Assessment:**

**Internal Assessment Test (IAT) for 15 marks each:**

- IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II.

**End Semester Theory Examination:**

**Question paper format**

- Question Paper will comprise a total of **five questions each carrying 15 marks Q.1** will be **compulsory** and should **cover the maximum contents of the syllabus**
- **Remaining questions** will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)
- A total of **three questions** need to be answered

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Pract. | Tut. | Theory | Pract. | Tut. | Total |
| BSL101 | Applied Physics Lab | -- | 1 | - | -- | 0.5 | - | 0.5 |