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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course code** | | | **Course title** | | | | | | | | **L** | **T** | **P** | | **J** | **C** |
| **PHY1701** | | | **Engineering Physics** | | | | | | | | **3** | **0** | **2** | | **0** | **4** |
| **Pre-requisite** | | | **Physics of 12th standard or equivalent** | | | | | **Syllabus version** | | | | | | | | |
|  | | |  | | | | | V.2.1 | | | | | | | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| To enable the students to understand the basics of the latest advancements in Physics viz., Quantum Mechanics, Nanotechnology, Lasers, Electro Magnetic Theory and Fiber Optics. | | | | | | | | | | | | | | | | |
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| **Expected Course Outcome:** | | | | | | | | | | | | | | | | |
| 1. To understand the dual nature of radiation and matter.  2. To apply Schrodinger’s equations to solve finite and infinite potential problems.  3. To apply quantum ideas at the nanoscale.  4. To apply quantum ideas for understanding the operation and working principle of optoelectronic devices.  5. To analyze the Maxwell’s equations in differential and integral form.  6. To classify the optical fiber for different Engineering applications.  7. To apply concept of Lorentz Transformation for Engineering applications.  8. To demonstrate the quantum mechanical ideas – LAB | | | | | | | | | | | | | | | | |
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| **Student Learning Outcomes (SLO): 2, 4, 5, 9** | | | | | | | | | | | | | | | | |
| 2. Having a clear understanding of the subject related concepts and of contemporary issues  4. Having Sense-Making Skills of creating unique insights in what is being seen or observed (Higher level thinking  skills which cannot be codified)  5. Having design thinking capability  9. Having problem solving ability- solving social issues and engineering problems | | | | | | | | | | | | | | | | |
| **CO – SLO mapping**   |  |  |  |  | | --- | --- | --- | --- | | **Module** | **CO** | **SLO** | **Level of Correlation** | | 1 | CO\_01 | 2 | 3 | | 2 | CO\_02 | 2,9 | 3 | | 3 | CO\_03 | 4,9 | 3 | | 4 | CO\_04 | 4,9 | 3 | | 5 | CO\_05 | 4,9 | 3 | | 6 | CO\_06 | 4,5,9 | 3 | | 7 | CO\_07 | 4 | 3 | | | | | | | | | | | | | | | | | |
| **Module:1** | | **Introduction to Modern Physics** | | | | | **6 hours** | | | **CO: 1** | | | | | | |
| Planck’s concept (hypothesis), Compton Effect, Particle properties of wave: Matter Waves, Davisson Germer Experiment, Heisenberg Uncertainty Principle, Wave function, and Schrodinger equation (time dependent & independent). | | | | | | | | | | | | | | | | |
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| **Module:2** | | **Applications of Quantum Physics** | | | | | **5 hours** | | **CO: 2** | | | | | | | |
| Particle in a 1-D box (Eigen Value and Eigen Function), 3-D Analysis (Qualitative), Tunneling Effect (Qualitative) (AB 205), Scanning Tunneling Microscope (STM). | | | | | | | | | | | | | | | | |
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| **Module:3** | | **Nanophysics** | | | | | **5 hours** | | **CO: 3** | | | | | | | |
| Introduction to Nano-materials, Moore’s law, Properties of Nano-materials, Quantum confinement, Quantum well, wire & dot, Carbon Nano-tubes (CNT), Applications of nanotechnology in industry. | | | | | | | | | | | | | | | | |
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| **Module:4** | | **Laser Principles and Engineering Application** | | | | | **6 hours** | | **CO: 4** | | | | | | | |
| Laser Characteristics, Spatial and Temporal Coherence, Einstein Coefficient & its significance, Population inversion, Two, three & four level systems, Pumping schemes, Threshold gain coefficient, Components of laser, Nd-YAG, He-Ne, CO2 and Dye laser and their engineering applications. | | | | | | | | | | | | | | | | |
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| **Module:5** | | **Electromagnetic Theory and its application** | | | | | **6 hours** | | **CO: 5** | | | | | | | |
| Physics of Divergence, Gradient and Curl, Qualitative understanding of surface and volume integral, Maxwell Equations (Qualitative), Wave Equation (Derivation), EM Waves, Phase velocity, Group velocity, Group index , Wave guide (Qualitative) | | | | | | | | | | | | | | | | |
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| **Module:6** | | **Propagation of EM waves in Optical fibers and Optoelectronic Devices** | | | | | **10 hours** | | **CO: 6** | | | | | | | |
| Light propagation through fibers, Acceptance angle, Numerical Aperture, Types of fibers - step index, graded index, single mode & multimode, Attenuation, Dispersion-intermodal and intramodal. Sources-LED & Laser Diode, Detectors-Photodetectors- PN & PIN - Applications of fiber optics in communication- Endoscopy. | | | | | | | | | | | | | | | | |
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| **Module:7** | | **Special Theory of Relativity** | | | | | **5 hours** | | **CO: 7** | | | | | | | |
| Frame of reference, Galilean relativity, Postulate of special theory of relativity, Simultaneity, length contraction and time dilation. | | | | | | | | | | | | | | | | |
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| **Module:8** | | **Contemporary issues:** | | | | | **2 hours** | | **CO: 1-7** | | | | | | | |
| Lecture by Industry Experts | | | | | | | | | | | | | | | | |
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|  | | **Total Lecture hours:** | | | | | **45 hours** | |  | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | |
| 1.  2.  3.  4. | Arthur Beiser et al., Concepts of Modern Physics, 2013, Sixth Edition, Tata McGraw Hill. William Silfvast, Laser Fundamentals, 2008, Cambridge University Press.  D. J. Griffith, Introduction to Electrodynamics, 2014, 4th Edition, Pearson.  Djafar K. Mynbaev and Lowell L.Scheiner, Fiber Optic Communication Technology, 2011, Pearson | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | |
| 1.  2.  3.  4.  5.  6.  7.  8. | Raymond A. Serway, Clement J. Mosses, Curt A. Moyer Modern Physics, 2010, 3rd Indian Edition Cengage learning.  John R. Taylor, Chris D. Zafiratos and Michael A. Dubson, Modern Physics for Scientists and Engineers, 2011, PHI Learning Private Ltd.  Kenneth Krane Modern Physics, 2010, Wiley Indian Edition.  Nityanand Choudhary and Richa Verma, Laser Systems and Applications, 2011, PHI Learning Private Ltd.  S. Nagabhushana and B. Sathyanarayana, Lasers and Optical Instrumentation, 2010, I.K. International Publishing House Pvt. Ltd.,  R. Shevgaonkar, Electromagnetic Waves, 2005, 1st Edition, Tata McGraw Hill  Principles of Electromagnetics, Matthew N.O. Sadiku, 2010, Fourth Edition, Oxford.  Ajoy Ghatak and K. Thyagarajan, Introduction to Fiber Optics, 2010, Cambridge University Press. | | | | | | | | | | | | | | | |
| Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar | | | | | | | | | | | | | | | | |
| **List of Experiments** | | | | | | | **CO: 8** | | | | | | | | | |
|  | Determination of Planck’s constant using electroluminescence process | | | | | | | | | | | | | 2 hrs | | |
|  | Electron diffraction | | | | | | | | | | | | | 2 hrs | | |
|  | Determination of wavelength of laser source (He -Ne laser and diode lasers of  different wavelengths) using diffraction technique | | | | | | | | | | | | | 2 hrs | | |
|  | Determination of size of fine particle using laser diffraction | | | | | | | | | | | | | 2 hrs | | |
|  | Determination of the track width (periodicity) in a written CD | | | | | | | | | | | | | 2 hrs | | |
|  | Optical Fiber communication (source + optical fiber + detector) | | | | | | | | | | | | | 2 hrs | | |
|  | Analysis of crystallite size and strain in a nano -crystalline film using X-ray diffraction | | | | | | | | | | | | | 2 hrs | | |
|  | Numerical solutions of Schrödinger equation (e.g. particle in a box problem)  (can be given as an assignment) | | | | | | | | | | | | | 2 hrs | | |
|  | Laser coherence length measurement | | | | | | | | | | | | | 2 hrs | | |
|  | Proof for transverse nature of E.M. waves | | | | | | | | | | | | | 2 hrs | | |
|  | Quantum confinement and Heisenberg's uncertainty principle | | | | | | | | | | | | | 2 hrs | | |
|  | Determination of angle of prism and refractive index for various colour –Spectrometer | | | | | | | | | | | | | 2 hrs | | |
|  | Determination of divergence of a laser beam | | | | | | | | | | | | | 2 hrs | | |
|  | Determination of crystalline size for nanomaterial (Computer simulation) | | | | | | | | | | | | | 2 hrs | | |
|  | Demonstration of phase velocity and group velocity (Computer simulation) | | | | | | | | | | | | | 2 hrs | | |
| Total Laboratory Hours | | | | | | | | | | | | | | 30 hrs | | |
| Mode of evaluation: CAT / FAT | | | | | | | | | | | | | | | | |
| Recommended by Board of Studies | | | | 04-06-2019 | | | | | | | | | | | | |
| Approved by Academic Council | | | | No. 55 | Date | 13-06-2019 | | | | | | | | | | |