PHY1701	Engineering Physics	L	T	P	J	C
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Pre-requisite	Physics of 12th standard or equivalent	Syllabus version
		1.0

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.

Expected Course Outcome: : Students will be able to

1. Comprehend the dual nature of radiation and matter.
2. Compute Schrodinger's equations to solve finite and infinite potential problems.
3. Analyze quantum ideas at the nanoscale.
4. Apply quantum ideas for understanding the operation and working principle of optoelectronic devices.
5. Recall the Maxwell's equations in differential and integral form.
6. Design the various types of optical fibers for different Engineering applications.
7. Apply the various types of optoelectronic devices for designing a typical optical fiber communication system.
8. Demonstrate the quantum mechanical ideas

Student Learning Outcomes (SLO): 2, 4, 5, 9

Module:1	Introduction to Modern Physics	6 hours

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).

Module:2	Applications of Quantum Physics	6 hours

Particle in a 1-D box (Eigen Value and Eigen Function), 3-D Analysis (Qualitative), Tunneling Effect (Qualitative), Scanning Tunneling Microscope (STM).

Module:3	Nanophysics	6 hours

Introduction to Nano-materials, Moore's law, Properties of Nano-materials, Types of Nano-materials, Synthesis of Nano-materials (Top-down and Bottom-up approaches), Quantum confinement, Quantum well, wire & dot, Fullerenes, Carbon Nano-tubes (CNT), Applications of nanotechnology in industry.

Module:4	Laser Principles and Engineering Application	7 hours

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, CO_2 and their engineering applications.

Module:5	Electromagnetic Theory and its application	6 hours

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 (Qualitative), experimental evidence of light as em wave (Hertz experiment)		
Module:6	**Propagation of EM waves in Optical fibers**	**6 hours**
Light propagation through fibers, Acceptance angle, Numerical Aperture, Types of fibers - step index, graded index, single mode & multimode, Attenuation, Dispersion-intermodal and intramodal.		
Module:7	**Optoelectronic Devices & Applications of Optical fibers**	**6 hours**
Introduction to semiconductors, Direct and indirect bandgap, Sources-LED & Laser Diode, Detectors-Photodetectors- PN & PIN - Applications of fiber optics in communication-Endoscopy.		
Module:8	**Contemporary issues**	**2 hours**
Lecture by Industry Experts		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Arthur Beiser et al., Concepts of Modern Physics, 2013, Sixth Edition, Tata McGraw
2.	Hill.
3.	William Silfvast, Laser Fundamentals, 2008, Cambridge University Press.
4.	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.	Raymond A. Serway, Clement J. Mosses, Curt A. Moyer Modern Physics, 2010, 3rd Indian Edition Cengage learning.
2.	John R. Taylor, Chris D. Zafiratos and Michael A. Dubson, Modern Physics for Scientists and Engineers, 2011, PHI Learning Private Ltd.
3.	Kenneth Krane, Modern Physics, 2010, Wiley Indian Edition.
4.	Nityanand Choudhary and Richa Verma, Laser Systems and Applications, 2011, PHI
5.	Learning Private Ltd.
	S. Nagabhushana and B. Sathyanarayana, Lasers and Optical Instrumentation, 2010, I.K.
6.	International Publishing House Pvt. Ltd.,
7.	R. Shevgaonkar, Electromagnetic Waves, 2017, Tata McGraw
8.	Hill.
9.	Matthew N.O. Sadiku, Principles of Electromagnetics, 2010,
	Fourth Edition, Oxford.
	Ajoy Ghatak and K. Thyagarajan, Introduction to Fiber Optics, 2010, Cambridge University Press.
	S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, 2008, 3rd Edition, Wiley.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Experiments		**CO: 8**
1.	Determination of Planck's constant using electroluminescence process	2 hrs

2.	Electron diffraction	2 hrs
3.	Determination of wavelength of laser source (He -Ne laser and diode lasers of different wavelengths) using diffraction technique	2 hrs
4.	Determination of size of fine particle using laser diffraction	2 hrs
5.	Determination of the track width (periodicity) in a written CD	2 hrs
6.	Optical Fiber communication (source + optical fiber + detector)	2 hrs
7.	Analysis of crystallite size and strain in a nano -crystalline film using X-ray diffraction	2 hrs
8.	Numerical solutions of Schrödinger equation (e.g. particle in a box problem) (can be given as an assignment)	2 hrs
9.	Laser coherence length measurement	2 hrs
10.	Proof for transverse nature of E.M. waves	2 hrs
11.	Quantum confinement and Heisenberg's uncertainty principle	2 hrs
12.	Determination of angle of prism and refractive index for various colour – Spectrometer	2 hrs
13.	Determination of divergence of a laser beam	2 hrs
14.	Determination of crystalline size for nanomaterial (Computer simulation)	2 hrs
15.	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	25.06.2020		
Approved by Academic Council	No. 59	Date	24.09.2020