Course Code	18PYB101J	Course Name	PHYSICS: ELECTROMAGNETIC THEORY, QUANTUM MECHANICS, WAVES AND OPTICS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	2	5

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Physics and Nanotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Identify the applications of electric field on materials
CLR-2 :	Identify the applications of magnetic field on materials
CLR-3 :	Identify the significance of quantum theory
CLR-4 :	Create insights to the concepts of optical effects
CLR-5 :	Analyze the working principle of lasers and optical fibers
CLR-6 :	Utilize the concepts in physics for the understanding of engineering and technology

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Identify the effect of charge dynamics	2	80	70	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Analyze electromagnetic induction	2	85	75	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Apply quantum mechanics to basic physical problems	2	75	70	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Apply ray propagation and optical effects	2	85	80	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Identify the applications of lasers and optical fiber	2	85	75	H	-	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Apply the concepts of electromagnetic theory and mechanics in real time applications	2	80	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Del, divergence, curl and gradient operations in vector calculus	Magnetization, permeability and susceptibility	Introduction to Quantum mechanics	Introduction to interference	Absorption and emission processes-two level
	SLO-2	Gauss-divergence and Stoke's theorem	Classification of magnetic materials	Explanation of wave nature of particles	Introduction to diffraction	Einstein's theory of matter radiation A and B coefficients
S-2	SLO-1	Electric field and electrostatic potential for a charge distribution	Ferromagnetism	Black body radiation, Concept of Photon	Fresnel diffraction	Characteristics of laser beams
	SLO-2	Gauss' law and its applications	Concepts of ferromagnetic domains	Photoelectric effect, Compton effect	Fraunhofer diffraction	Amplification of light by population inversion
S-3	SLO-1	Laplace's equations for electrostatic potential	Hard and soft magnetic materials	de Broglie hypothesis for matter waves	Fraunhofer diffraction at single slit	Threshold population inversion
	SLO-2	Poisson's equations for electrostatic potential	Energy product	Physical significance of wavefunction	Fraunhofer diffraction at double slit	Essential components of laser system and pumping mechanisms
S-4	SLO-1	Solving Problems	Solving Problems	Solving Problems	Solving Problems	Solving Problems
	SLO-2	Solving Problems	Solving Problems	Solving Problems	Solving Problems	Solving Problems
S 5-6	SLO-1 / SLO-2	Basics of experimentation	Calibrate Ammeter using Potentiometer	Determine Planck's Constant	Determine wavelength of monochromatic light Newton's ring	Determine laser parameters – divergence and wavelength for a given laser source
S-7	SLO-1	Concepts of electric current	Ferrimagnetic materials	Time independent Schrödinger's wave equation	Fraunhofer diffraction at multiple slit	Nd: YAG laser
	SLO-2	Continuity equation	Ferrites-regular spinel and inverse spinel	Time independent Schrödinger's wave equation	Diffraction grating	Semiconductor laser
S-8	SLO-1	Laws of magnetism Faraday's law	Magnetic bubbles	Time dependent Schrödinger's wave equation	Characteristics of diffraction grating	CO_2 laser: Vibrational modes
	SLO-2	Ampere's law	Magnetic thin films	Time dependent Schrödinger's wave equation	Applications of diffraction grating	CO_2 laser: energy level

S-9	SLO-1	*Maxwell's equations*	*Spintronics*	*Particle in a 1 D box*	*Polarization by reflection*	*Optical fiber-physical structure*
	SLO-2	*Maxwell's equations*	*GMR*	*Normalization*	*Polarization by double refraction*	*Total internal reflection*
S-10	SLO-1	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S 11-12	SLO-1 SLO-2	*Determine Coulomb's potential and Coulomb's field of metal spheres*	*Calibrate Voltmeter using Potentiometer*	*Repeat/Revision of experiments*	*Determine particle size using laser*	*Study of attenuation and propagation characteristic-optical fiber*
S-13	SLO-1	*Polarizations, permeability and dielectric constant*	*TMR*	*Born interpretation of wave function*	*Scattering of light*	*Numerical aperture*
	SLO-2	*Polar and non-polar dielectrics*	*CMR*	*Verification of matter waves*	*Circular polarization*	*Acceptance angle*
S-14	SLO-1	*Types of polarization*	*Garnets*	*Concept of harmonic oscillator*	*Elliptical polarization*	*Losses associated with optical fibers*
	SLO-2	*Frequency and temperature dependence*	*Magnetoplumbites*	*Quantum harmonic oscillator*	*Optical activity*	*Classification of optical fibers*
S-15	SLO-1	*Internal field in a field*	*Multiferroic materials*	*Hydrogen atom problem*	*Fresnel's relation*	*Optical fiber communications system*
	SLO-2	*Clausius-Mossotti equation*	*Applications of multiferroic materials*	*Hydrogen atom problem*	*Brewster's angle*	*Optical sensors*
S-16	SLO-1	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
	SLO-2	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*	*Solving Problems*
S 17-18	SLO-1 SLO-2	*Determine dielectric constant of the sample (Expt-2)*	*Determine magnetic susceptibility-Quincke's method*	*Study of I-V characteristics of a light dependent resistor (LDR)*	*Determine Wavelength- diffraction grating*	*Mini project*

Learning Resources	*1.David Jeffery Griffiths, Introduction to Electrodynamics, Revised Edition, Pearson, 2013* *2.Ajay Ghatak, Optics, Tata McGraw Hill Education, 5th Edition, 2012*	*3.David Halliday, Fundamentals of Physics, 7th edition, John Wiley & Sons Australia, Ltd, 2004* *4. Eisberg and Resnick, Quantum Physics: Of Atoms, Molecules, Solids, Nuclei and Particles, John Wiley & Sons, 2nd Edition, 1985*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

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