CE, CSE, EECE, ME DEPT

Physics

Spring Semester: L-1, T-1

COURSE INFORMATION			
Course Code	**PHY 101**	Lecture Contact Hours	: **3.00**
Course Title	**Physics (Waves and Oscillations, Optics and Modern Physics)**	Credit Hours	: **3.00**

PRE-REQUISITE

N/A

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course is the basic physics in Waves and Oscillations, Optics, and Modern physics. The course will be emphasized the basic concepts, various theoretical aspects, and solving quantitative problems which may be applicable in a wide spectrum of engineering disciplines.

OBJECTIVE

1. To define the different parameters and concepts of Waves and Oscillations, Optics, and Modern physics.
2. To explain the basic theories of Waves and Oscillations, Optics, and Modern physics.
3. To solve numerical problems regarding Waves and Oscillations, Optics, and Modern physics.

LEARNING OUTCOMES & GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	KP	CP	CA	Assessment Methods
CO1	Be able to Define different basic parameters in the field of Waves and Oscillations, Optics and Modern physics such as periodic motion, simple harmonic motion, undamped oscillations, interference, diffraction, polarization and prism, photoelectric effect, Compton effect, matter wave, atomic model, radioactive decay, fusion, fission etc.	1	C1	1	-	-	Quiz, Mid Term Examination, Final Exam
CO2	Be capable to Explain different basic theories in the field of Waves and Oscillations, Optics and Modern physics such as the wave motion for different systems along with energy, different formula for interference, diffraction, polarization special theory of relativity, Compton theory, nuclear transformation, and nuclear reaction etc.	1	C1	1	-	-	Mid Term Examination, Final Exam
CO3	Be skilled to Solve quantitative problems in the field of Waves and Oscillations, Optics and Modern physics such as energy of wave motion, wavelength, diffraction pattern, photon energy, Compton shift, nuclear binding energy etc.	1	C2	2			Class Assessment, Quiz, MidTerm Examination, Final Exam
(CP – Complex Problems, CA – Complex Activities, KP – Knowledge Profile, T – Test, PR – Project, Q – Quiz, ASG – Assignment, Pr – Presentation, R – Report, CS – Case study, F – Final Exam)							

COURSE CONTENT

Waves and Oscillations: Simple Harmonic Motion (SHM) and its properties, Differential equation of a SHM and its solution, total energy of a body executing SHM, average kinetic and potential energy of a body executing SHM, LC oscillatory circuit, Pendulum: simple, compound and torsional pendulum, spring-mass system, two body oscillation and reduced mass, damped harmonic motion and its different condition, forced oscillation and its different condition, resonance, equation of a progressive wave, differential equation of a progressive wave, energy density of wave motion, average kinetic and potential energy of a body executing SHM, Stationary wave.

Optics: Lens, equivalent lens and power, defects of images and different aberrations, Interference of light, Young's double slit experiment, Interference in thin film and Newton's ring method, diffraction of light, diffraction by a single slit, diffraction by double slits, Fraunhofer and Fresnel bi-prism, diffraction gratings, the polarization of light, Brewster's law, Malus law, polarization by double refraction Nicole prism, optical activity, and polarimeters, optical instruments, resolving power of the optical instrument, Laser: spontaneous and stimulated emission.

Modern physics: Galilean relativity & Reference frame, Special theory of relativity postulates, Galilean transformation, Lorentz Transformation, Length contraction, Time dilation, Velocity addition, the relativity of mass, mass-energy relation, Momentum energy relation, Photoelectric effect, Compton effect, de Broglie matter wave, Bohr atom model and explanation, atomic orbital and energy equation, classification of the nucleus, nuclear binding energy, radioactivity, radioactive decay law, half-life, mean life, nuclear reaction, introduction to a nuclear reactor.

CO-PO MAPPING												
No.	Course Outcome	PROGRAM OUTCOMES (PO)										
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to Define different basic parameters in the field of Waves and Oscillations, Optics and Modern physics such as periodic motion, simple harmonic motion, undamped oscillations, interference, diffraction, polarization and prism, photoelectric effect, Compton effect, matter wave, atomic model, radioactive decay, fusion, fission etc.	√											
CO2	Be capable to Explain different basic theories in the field of Waves and Oscillations, Optics and Modern physics such as the wave motion for different systems along with energy, different formula for interference, diffraction, polarization special theory of relativity, Compton theory, nuclear transformation, and nuclear reaction etc.	√											
CO3	Be skilled to Solve quantitative problems in the field of Waves and Oscillations, Optics and Modern physics such as energy of wave motion, wavelength, diffraction pattern, photon energy, Compton shift, nuclear binding energy etc.	√											

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	**Level of Matching**	**Justification**
CO1-PO1	3	The conceptual knowledge of the natural sciences applicable to the engineering discipline
CO2-PO1	3	The theory-based knowledge of the natural sciences applicable to the engineering discipline
CO3-PO1	3	The numerical analysis based knowledge of the natural sciences applicable to the engineering

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	42
Self-Directed Learning	75
Formal Assessment	5.5
Total	**122.5**

TEACHING METHODOLOGY
Class Lecture, Pop quiz, Case study, Problem solving

COURSE SCHEDULE			
Weeks		**Topics**	**Remarks**
Week-1	1	Introductory class: Brief discussion on total syllabus, basic requirements of the course, assessment of the course	CT-1/ Assignment
	2	Simple harmonic motion (SHM) and its differential equations, graphical representation of SHM	
	3	Average K.E and total energy	
Week-2	4	Spring-mass system , electric oscillatory circuit	
	5	Simple, compound and torsional pendulum	

	6	Combination of two SHM	
Week-3	7	Combination of two SHM	
	8	Two body oscillations, reduced mass	
	9	Damped oscillations and its differential equation	
Week-4	10	Displacement equation of damped oscillation, electric damped oscillatory circuit	CT-2 /Assignment
	11	Forced oscillation and its differential equation	
	12	Displacement equation of forced oscillation, resonance	
Week-5	13	Plane progressive wave, energy density of wave	
	14	Stationary wave	
	15	Lens and combination of lenses, power of lens	
Week-6	16	defects of images and different aberrations	Mid Term/ Assignment
	17	defects of images and different aberrations	
	18	Interference of light, young's double slit experiment	
Week-7	19	Interference in Thin films, Newton's ring	
	20	Diffraction: Fresnel & Fraunhofer diffraction	
	21	Diffraction by single slit	
Week-8	22	Diffraction by double slit, Diffraction gratings	
	23	Polarization and Production and analysis of polarized light	
	24	Optics of crystals, Nicole prism	
Week-9	**25**	Brewster's and Malus law	
	26	Optical activity and polarimeter	
	27	Laser & its applications	

Week-10	**28**	Theory of relativity: Frame of Reference, Postulates of special relativity, Galilean Transformation	
	29	Theory of relativity: Lorentz Transformations, Length Contraction and Time dilation	
	30	Velocity addition, Relativistic mass: Concept of relativistic mass and its expression	
Week-11	**31**	Theory of relativity: Mass and Energy equivalence equation and concept of Massless particle and its expression. Related numerical problems	
	32	Photoelectric Effect, photocurrent and work function, kinetic energy, stopping potential	
	33	photoelectric equation, characteristics of photoelectric effect	
Week-12	**34**	Compton effect: Definition, Compton wavelength shift, limitation	CT-3 /Assignment
	35	De Broglie Concept, Condition for wave and particle behavior, Bohr atomic model	
	36	Expression for Bohr radii and orbital energy for hydrogen atom	
Week-13	**37**	Classification of Nucleus, nuclear binding energy	
	38	Radioactivity and its transformation, Radioactive Decay Law,	
	39	half- life, Mean life, nuclear reaction	
Week-14	**40**	Concept of Fusion, Fission and nuclear chain reaction	
	41	General idea on nuclear reactor and nuclear power plant	
	42	Follow up the course	

ASSESSMENT STRATEGY

	COs	Assessment Method	(100%)	Remarks
		Class Assessment		
	1	Assignment	**20**	
	2	Assignment	**20**	
		Exam		
	1	Final Exam, CT	**80**	
	2	Final Exam, CT, MID	**80**	
	3	Final Exam, CT	**100**	

REFERENCE BOOKS

1. Fundamentals of Physics : Halliday, Resnick and Walker
2. Physics for Scientists and Engineers: Serway and Jewett
3. Concept of Modern Physics: Arthur Beiser
4. University Physics with Modern Physics: Hugh D. Young and Roger A. Freedman
5. Modern Physics for Science and Engineering: Marshall L. Burns
6. Waves and Oscillations: Walter Fox Smith
7. The Physics of Vibrations and Waves: H. J. Pain
8. Waves and Oscillations : BrijLal and Subramannyam
9. Fundamental of Optics: Francis A. Jenkins and Harvey E.White
10. Introduction to Modern Optics: Grant R. Fowles
11. Fundamental Optical Design: Michael J. Kidger
12. **Physics for Engineers : Part-1 & Part-2 :** Dr Gias Uddin Ahmad

Course Teachers

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