FEBRUARY 2023 EXAMINATION **1213**
I YEAR B.E./B.TECH EXAMINATION
PH-10016: PHYSICS

TIME: 3 Hrs. **Max. Marks: 70**

Note: Total questions are 5. Parts (a), (b) and (c) are compulsory. Attempt any one question from (d) or (e) section.

S.No	Questions	Marks	CO	BL	PI
Q.1.					
(a)	A progressive sinusoidal wave is represented by $Y(x, t) = A \sin [(0.2\ m^{-1})\ x - (0.4\ s^{-1})\ t + \pi/6]$, where x and t are in meter and second respectively. Determine the speed of propagation of the wave.	**(2)**	1,4	2,3	1.6
(b)	Explain the physical significance of Gauss and Stoke's theorems.	**(2)**	2,4	1,2	1.5
(c)	A particle with a proper lifetime of 1 μs moves through the laboratory at $2.7 \times 10^8\ ms^{-1}$. (i) What is its lifetime, as measured by observers in the laboratory? (ii) What will be the distance traversed by it before disintegrating?	**(3)**	1,4	3,5	1.2
(d)	What are Maxwell's equations? State and Derive Maxwell's equations in differential form.	**(7)**	2,4	1,3	2.3
	OR				
(e)	Define Poynting vector. Derive an expression for it and explain its physical significance for electromagnetic wave in free space.	**(7)**	2,4	2,4	2.2
Q.2					
(a)	In a Newton's rings experiment the diameter of 10^{th} ring changes from 1.40 to 1.27 cm when a drop of liquid is introduced between the lens and the glass plate. Calculate the refractive index of the liquid.	**(2)**	2,4	2,5	1.6
(b)	A monochromatic light of wavelength 650 nm falls normally on a grating. The first order spectrum is observed at 15° from the mean position. Calculate the grating element.	**(2)**	3,4	3,5	1.2
(c)	Define resolving power of an optical instrument? Explain Rayleigh's criterion for limit of resolution.	**(3)**	1,3	1,2	1.4
(d)	Describe and explain the formation of Newton's rings in reflected light. Prove that in reflected light the diameter of the dark rings is proportional to the square roots of natural numbers.	**(7)**	2,3	2,3	1.5
	OR				
(e)	Discuss the phenomenon of Fraunhofer's diffraction at a single slit and determine the conditions for maximum and minimum.	**(7)**	2,3	3,4	1.2
Q .3					
(a)	The lifetime of an excited state of an atom is about 10^{-8} sec. calculate the minimum uncertainty in the determination of the energy of the excited state.	**(2)**	1,4	2,4	1.6
(b)	What are matter waves? Write any four properties of matter waves.	**(2)**	1,2	2,3	2.2
(c)	Calculate the de Broglie wavelength associated with (i) A 46-gm golf ball with velocity 36 m/s (ii) An electron with a velocity 10^7 m/s Which of these two, show wave character and why?	**(3)**	2,4	2,4	1.2

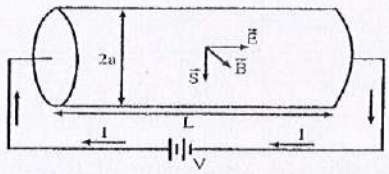
ONLINE EXAMINATION JULY 2022

B.E. (All BRANCHES)

PH10006 / PH10002 : PHYSICS

Time: 180 min | Total Number of Questions: 5 | Max. Marks: 70

NOTE: *Attempt any* TWO *part of each question. Each part carry 7 marks.*

Questions	CO	BL	PI
1a.- State Poynting theorem. With the help the given figure drive the expression for energy per unit time ($\vec{S}$) passing through the surface of the wire. Symbols have their usual meanings. **(03+04)** 	1,4	3	2.1.2
1b.- Prove the following (i) Electromagnetic wave have transverse nature. **(02)** (ii) $x^2+y^2+z^2=c^2t^2$ is invariant under Lorentz transformation. **(03)** (iii) Velocity of light in free space $= 1/\sqrt{\mu_o\epsilon_o}$ (Hint: Use Maxwell's equation) **(02)**	2,4	2	1.3.1
1c.- State fundamental postulates of special theory of relativity and deduce Lorentz transformation of space and time. **(03+04)**	3,4	3	1.3.1
2a.- Explain the theory of plane transmission grating for gating n^{th} order maxima. Also, compare the diffraction pattern of grating with that of a single slit. **(05+02)**	1,2	4	2.2.4
2b.- Define resolving power, limit of resolution, Rayleigh criteria and calculate the **(03)** (ii) angular position of 4^{th} order maxima, if for the normal illumination of a transmission grating, the first order diffraction maxima is at 12^o. **(02)** (iii) diameter of a telescope lens, if at 600nm the required resolution is $0.1''$. **(02)**	3,4	5	2.3.1
2c.- For sustained interference we need two coherent sources. With the help of necessary theory and diagram demonstrate the application of interference in laboratory. However you have a sodium vapor lamp. **(07)**	1,4	3	4.1.3
3a.- Discuss Heisenberg uncertainty principle and explain the following. **(03)** (i) Quantization of energy level of an atom. **(02)** (ii) Non existence of electron in nucleus. **(02)**	1,2	2	1.2.1
3b.- What is Compton effect ? Why the effect is significant only for microscopic particles ? Develop the expression for Compton shift and angle of recoil. **(01+01+05)**	1,2	3	2.3.2
3c.- Deduce eigenfunction and eigenvalues of an electron in a deep potential well of width L. Find the probability of finding the electron in first exited state between 0.45L and 0.55L of the well. **(04+03)**	2,4	5	2.3.1
4a.- Prove that, being the negative temperature state, the population inversion can be achieved at room temperature. Why the two level lasing is not possible ? **(04+03)**	2,3	2	1.2.1
4b.- Draw energy level transitions in He-Ne laser showing values of each level and lasing wavelengths. Also, for selective wavelength lasing, discuss the significance of He:Ne ratio, tube diameter and length of the optical cavity. **(03+04)**	2,3	1	2.1.3
4c.- Describe the construction and working of ruby laser. What is the main drawback of ruby laser ? Calculate the number of photon per pulse of ruby laser that emits pulses of 0.15 J for 12 ps and emits light of wavelength 694.4 nm. **(04+01+02)**	2,4	3	2.1.2
5a.- Briefly describe intermodal and intramodal dispersion in optical fiber. Drive the expression for total time delay due to modal dispersion in step index fiber: **(03+04)**	1,3	4	3.3.1
5b.- In optical fiber, why cladding is required? If the cut-off angle for light entering a step index fiber ($n_{core} = 1.425$) from air is 8.50^o find the values of **(02)** (i) Numerical aperture (NA), fractional refractive index and n_{clad} of the fiber ? **(03)** (ii) How the value of these parameter changes when fiber submersed in water ? **(02)**	1,4	3	2.1.2
5c.- Explain the terms normalized frequency, numerical aperture, acceptance angle and fiber optic communication system. On the basis of mode of fiber and type of index, which fiber will you prefer for long distance communication and why ? **(04+03)**	2,3	1	5.2.1

Detail of COs, BL and PIs

Course Outcome (CO)
1. Knowledge of multiphysics to understand engineering problems
2. Skills to use logic towards engineering problems with multiphysics implementation.
3. Ability to use modern engineering physics techniques and tools.
4. Solve engineering problems with the knowledge of basic and applied physics.

Bloom's Taxonomy Levels (BL): 1-Remembering, 2-Understanding, 3-Applying, 4-Analyzing, 5-Evaluating, 6-Creating

Unit	Remember (1)		Understand (2)		Apply (3)			Analyzing (4)	Evaluate (5)	Create (6)	
	Recall	Label	Prove	Explain	Use	Develop	Find	Compare	Calculate	Build	Tot.
I	-	-	7	-	7	7	-	-	-	-	21
II	-	-	-	-	7	-	-	7	7	-	21
III	-	-	-	7	-	7	-	-	-	-	14
IV	-	7	7	-	-	-	7	-	7	-	28
V	7	-	-	-	-	-	7	7	-	-	21
Tot.	14		21		42			14	14	0	105

Table 1: Table of specifications (TOS) for the allocation of Bloom's taxonomy levels

Program Outcomes (POs)	Performance Indicator (PI)	
Engineering knowledge	1.2.1	Apply laws of natural science to an engineering problem
	1.3.1	Apply fundamental physics concepts to solve engineering problems
Problem analysis	2.1.2	Identify systems, variables, and parameters to solve the problems
	2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
	2.2.4	Compare and contrast alternative solution processes to select the best process.
	2.3.1	Combine scientific principles and engineering concepts to formulate mathematical models of a system or process that is appropriate in terms of applicability and required accuracy.
	2.3.2	Identify assumptions (mathematical and physical) necessary to allow modeling of a system at the level of accuracy required.
Design / Development of Solutions	3.3.1	Apply formal decision making tools to select optimal solutions for further development
Conduct investigations of complex problems	4.1.3	Apply appropriate instrumentation and/or software tools to make measurements of physical quantities
Modern tool usage	5.2.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.

Table 2: List of program outcomes and the relevant performance indicators

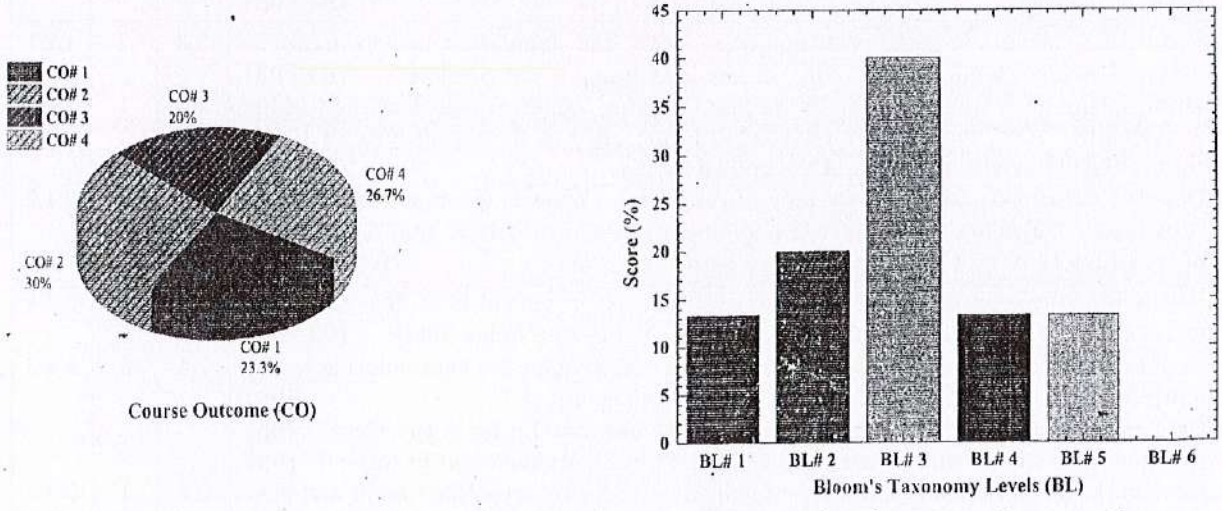


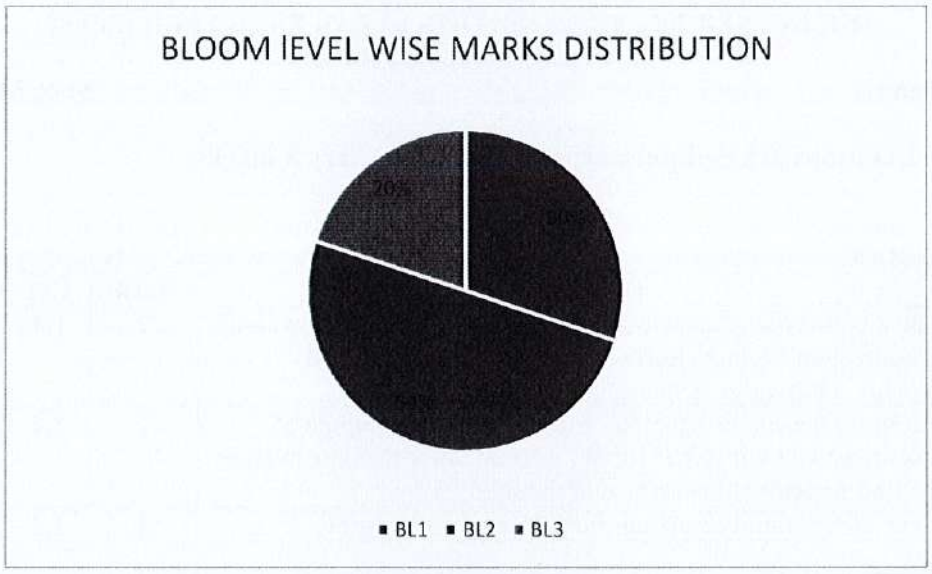
Figure-2: Mapping of COs and BLs with the score covered by the respective questions.

ONLINE FEB 2022 EXAMINATION I YEAR B.E./B.TECH EXAM
PH-10006/PH 10002PHYSICS

TIME: 90 mins **Max. Marks: 40**

NOTE: All questions are compulsory, each question carry 8 marks.

S.No	Questions	Marks	CO	BL	PI
Q1(a)	Draw a sketch of a plane electromagnetic wave propagating along the z-direction. Depict clearly the direction of electric and magnetic fields varying sinusoidally with z.	2	1,4	1,	1.2.1
(b)	If radius of the sun be equal to $7*10^8$m and the magnitude of power radiated by it is $3.5*10^{26}$W, then calculate the time average Poynting's vector at the surface of the sun.	2	2,4	1,2	1.2.1
(c)	Derive the continuity equation from Maxwell's equation.	4	1,4	3	1.2.1
Q2(a)	In a Newton's ring experiment the diameter of the 15th ring was found to be 0.59cm and that of the 5th ring was 0.336cm. If the radius of the plano-convex lens is 100cm. calculate the wavelength of the light used.	4	2,4	2	1.2.1
(b)	Deduce the missing orders for a double slit Fraunhofer diffraction pattern, if the slit widths are 0.16mm and they are 0.8mm apart.	2	2,4	2	1.2.1
(c)	Give the construction and theory of a plane diffraction grating of the transmission type and obtain expressions for principal maxima, minima and secondary maxima.	4	1,3	3	1.2.1
Q3(a)	X-rays of wavelength $1.2A^0$ are scattered by a carbon target at an angle of 60^0. Calculate the wavelength of scattered X-ray. Given: $h=6.6*10^{-34}$Js,$c=3*10^8ms^{-1}$,$m=9.1*10^{-31}$Kg.	2	2,4	1,2	1.2.1
(b)	Calculate the energy required for an electron to jump from ground state in a potential well of width L	2	1,3	2	1.2.1
(c)	Write Heisenberg's uncertainty principle. Use Heisenberg's uncertainty principle to show that the binding energy of electrons in the hydrogen atom is nearly 15eV	4	1,3	3	1.2.1
Q4 (a)	The wavelength of emission is $6000A^0$and the coefficient spontaneous emission is 10^6per sec. Determine the coefficient for the stimulated emission.	2	2,4	1,2	1.2.1
(b)	A relative population or Boltzmann ration of 1/e is often is considered representative of the ratio of population in two energy states at room temperature T=300K. Determine the wavelength of radiation emitted at that temperature.	2	1,3	1,2	1.2.1
(c)	Describe the principle and working of He-Ne laser.	4	1,2	3	1.2.1
Q5(a)	Explain the phenomenon of total internal reflection of light. How is it used in fiber optic communications?	2	1,4	1,2	1.2.1
(b)	In an optical fiber, the core material has refractive index 1.6 and refractive index of clad material is 1.3. What is the value of critical angle? Also calculate the value of acceptance cone	2	2,4	2	1.2.1
(c)	Derive an expression for acceptance angle and numerical aperture for step index fiber with the help of suitable diagram.	4	1,3	2	1.2.1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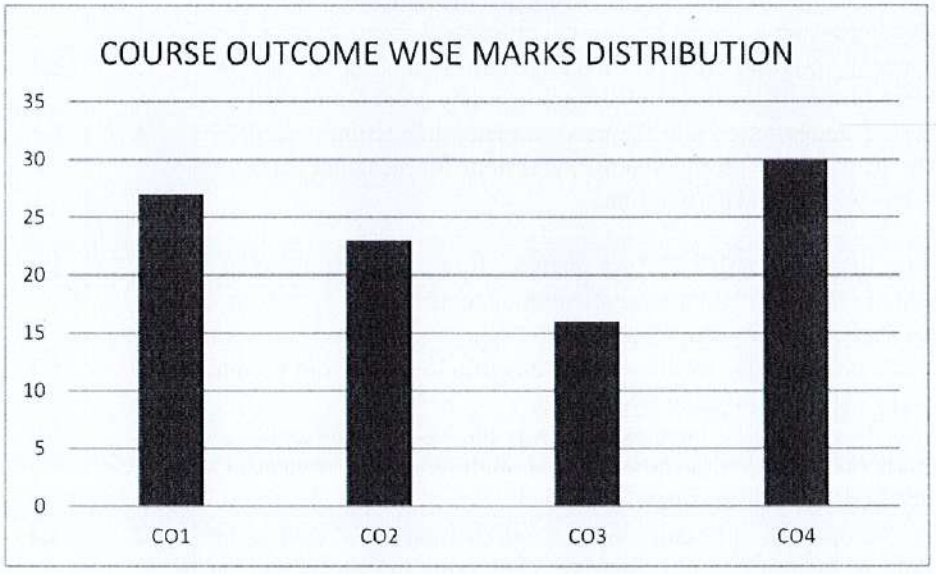
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