Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Engineering Physics — **Semester: II**
Program: B.Tech. CS (All Batches) — **Time : 03 hrs.**
Course Code: PHYS 1023 — **Max. Marks: 100**

Instructions:

- **There are 3 Sections such as Section A, B & C.**
- **Section A is compulsory, however, Section B & Section C have internal choices.**
- **Scientific calculator is allowed.**

SECTION A
$(5\,Q \times 4\,M = 20\,Marks)$

S. No.		Marks	CO
Q 1.	Distinguish ordinary Photography and Holography pointwise.	**4**	**CO1**
Q 2.	Prove that $\vec{E} = -\vec{\nabla} V$ where $\vec{E}$ is electric field intensity and V is electric potential and $\vec{\nabla}$ is the gradient of V.	**4**	**CO2**
Q 3.	Define magnetic flux density and explain that an isolated magnetic charge does not exist.	**4**	**CO3**
Q 4.	Calculate the maximum percentage change in wavelength due to Compton scattering for incident photons of wavelengths $1\,\text{Å}$ and $10\,\text{Å}$.	**4**	**CO4**
Q 5.	State the various applications of nanomaterials.	**4**	**CO5**
	SECTION B $(4\,Q \times 10\,M = 40\,Marks)$		
Q 6.	Explain the construction and working of a Ruby laser using suitable diagrams.	**10**	**CO1**
Q 7.	Derive the expression for boundary conditions between two different dielectric materials along with schematic diagrams.	**10**	**CO2**
Q 8.	a) Given the magnetic flux density $\vec{B} = \frac{\square}{2}\hat{a}_{\phi}$ Wb/m, calculate the total magnetic flux crossing the surface $\varphi = \frac{\pi}{2}$, $1 < \rho < 3$ meters and $0 < z < 3$ meters b) Distinguish bits and qubits in quantum computing and define quantum confinement.	**5** **5**	**CO3** **CO5**
Q 9.	The work function for lithium is $4.6 \times 10^{-19}\,J$.	**10**	**CO4**

	(a) Calculate the lowest frequency of light that will cause photoelectric emission. (b) What is the maximum energy of the electrons emitted when light of 7.3×10^{14} *Hz*is used? **OR** A metallic surface, when illuminated with light of wavelength λ_1, emits electrons with energies upto a maximum value E_1, and when illuminated with light of wavelength λ_2, where $\lambda_2 < \lambda_1$, it emits electrons with energies upto a maximum value E_2. Prove that Planck's constant h and the work function φ of the metal are given by; $h = \frac{(E¿¿2 - E_1)\lambda_1\lambda_2}{C(\lambda_1 - \lambda_2)}¿$ and $\varphi = \frac{E_2\lambda_2 - E_1\lambda_1}{(\lambda_1 - \lambda_2)}$		
	SECTION-C $(2Q \times 20M = 40\ Marks)$		
Q 10.	(a) Derive an expression to establish a relation between the acceptance angle and the refractive indices of the core and the cladding. (b) Discuss the photoelectric effect with diagram and various characteristic graphs.	**10** **10**	**CO1** **CO4**
Q 11.	(a) Derive the expression of the pair production and pair annihilation. Justify that the pair production phenomenon cannot happen in empty space. (b) In a certain conducting region, $\boldsymbol{H} = yz(x^2 + y^2)\,\boldsymbol{a}_x - y^2xz\,\boldsymbol{a}_y + 4x^2y^2\boldsymbol{a}_z\,A/m$. Determine the value of **J** at (5, 2, -3). **OR** (a) Derive an expression for a normalized wave function for a particle of mass m moving in a one-dimension box of length L. Use schematic diagrams to analyze the behavior of wave function and probability density of wave function in the box. (b) A steady current element of $10^{-3}\mathbf{a}_z$ A.m is located at the origin in free space. Determine the magnetic field intensity due to this current element at (1, 0, 0).	**15** **5** **15** **5**	**CO4** **CO3** **CO4** **CO3**

	Standard Physics Constants and their values: **Constants** | **Standard values** Planck's constant (h) | $6.626 \times 10^{-34}\ Js$		

		Permittivity of free space $(\varepsilon ¿ ¿ 0) ¿$	$8.854 \times 10^{-12} F/m$			
		Velocity of light (c)	$3 \times 10^{8} m/s$			
		Boltzmann constant (k_B)	$1.38 \times 10^{-23} J/K$			
		Rest mass of an electron (m_0)	$9.11 \times 10^{-31} k g$			
		Charge on electron (e)	$1.6 \times 10^{-19} C$			