Name: Enrolment No:	UPES UNIVERSITY OF TOMORROW

UPES
Supplementary Examination, December-2023

Course: Engineering Physics **Semester : I/Odd**
Program: B. Tech. CSE (All Batches) **Time : 03 hrs.**
Course Code: PHYS1023 **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
(5Q × 4M = 20 Marks)

S. No.		Marks	CO
Q 1.	With suitable diagram, explain the construction of a hologram.	4	CO1
Q 2.	Find $\vec{\nabla}.\ \vec{A}$ Given, $\vec{A} = x^2\, y\hat{\imath} + (x - y)\hat{k}$	4	CO2
Q 3.	Write Maxwell's equations in integral form for time-varying fields.	4	CO3
Q 4.	Show that the wavelength λ associated with a particle of mass m and kinetic energy E is given by; $$\lambda = \frac{h}{\sqrt{2mE}}$$ Where, h is the Planck's constant.	4	CO4
Q 5.	Define nanomaterials. State the various applications of nanomaterials.	4	CO5

SECTION B
(4Q × 10M = 40 Marks)

Q 6.	Describe the propagation mechanisms of light waves in an optical fibre.	10	CO1
Q 7.	Derive the boundary conditions between two different dielectric materials along with appropriate diagrams.	10	CO2
Q 8.	Distinguish bits and qubits in quantum computing and define quantum confinement.	10	CO5
Q 9.	Calculate Compton shift if X-rays of wavelength 1.0 Å are scattered from a carbon block. The scattered radiation is viewed at 90^0 to the incident beam. **OR**	10	CO4

	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) State Faraday's law of electromagnetic induction. How it can be expressed as one of the Maxwell's equations for time varying field?	**10**	**CO3**
	(b) Write the physical significance of wave function ψ. Derive time-independent Schrodinger wave equation.	**10**	**CO4**
Q 11.	(a) Derive an expression for a normalized wave function for a particle of mass m moving in a one-dimensional box of length L. Use schematic diagrams to analyze the behavior of wave function and probability density of wave function in the box.	**15**	**CO4**
	(b) Explain Gauss divergence and Stoke's theorems with mathematical expressions.	**5**	**CO3**
	OR		
	(a) Explain the pair production and pair annihilation. Show that the pair production cannot occur in free space.	**15**	**CO4**
	(b) Determine the total current in a wire of radius 1.6 mm if, $\boldsymbol{J} = \frac{500\,\boldsymbol{a_z}}{\rho}\,\frac{A}{m^2}$.	**5**	**CO3**

Standard Physics Constants and their values:

Constants	Standard values
Planck's constant (h)	$6.626 \times 10^{-34}\,Js$
Permittivity of free space (ε_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)	$9.11 \times 10^{-31}\,kg$
Charge on electron (e)	$1.6 \times 10^{-19}\,C$