Name: Enrolment No:	UPES UNIVERSITY OF TOMORROW

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

Course: Engineering Physics **Semester : I**
Program: B.Tech. CS (Batches 1-20) **Time : 03 hrs.**
Course Code: PHYS 1023 **Max. Marks: 100**

Instructions:

- All questions are compulsory (**Q. No. 9** and **Q. No. 11** has an internal choice)
- All **highlighted** representations are **vector quantities**.
- Scientific calculators can be used for calculations.

SECTION A

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

- All questions are compulsory, Each Question carries **4 Marks**
- Write very Short Answers/ Solve

Q. No.	Statement of question	Marks	CO
Q 1.	The surfaces $\rho = 3, \phi = 100^{\circ}, z = 3$ and $\rho = 5, \phi = 130^{\circ}, z = 4.5$ define a closed surface. Find the enclosed volume.	**4**	**CO2**
Q 2.	Outline Maxwell's equations in differential and integral forms for time variant fields.	**4**	**CO2**
Q 3.	Explain Ampere's Circuital law with proper diagram.	**4**	**CO3**
Q 4.	Calculate the de-Broglie wavelength of an α particle accelerated through a potential difference of 200 volts.	**4**	**CO4**
Q 5.	Explain quantum computing and its application.	**4**	**CO5**

SECTION B

($4Q \times 10M = 40$ Marks)

- All questions are compulsory, **Q 9.** has an internal choice, Each Question carries **10 Marks**
- Write Short/ Brief notes/ Derive/ Solve

Q 6.	Define Electric potential and establish a relation between electric potential and electric field intensity. Show that the Electrostatic field is a conservative field. **(10)**	**10**	**CO2**
Q 7.	**(a)** Explain Faraday's Law of induction. Apply Faraday's law to describe motional EMF. **(4)** **(b)** In a certain conducting region, $\mathbf{H} = yz(x^2 + y^2)\boldsymbol{a_x} - y^2xz\boldsymbol{a_y} + 4x^2y^2\boldsymbol{a_z}$ A/m. Determine the value of **J** at $(5, 2, -3)$**.** **(6)**	**10**	**CO3**
Q 8.	**(a)** Mention any four differences between a classical computer and quantum computer. **(4)** **(b)** Given $\|\psi\rangle = 3\|0\rangle - 2i\|1\rangle$. Find its normalized state. **(6)**	**10**	**CO5**
Q 9.	**(a)** What are the important conclusions that can be drawn from the Davisson and Germer's experiment? **(5)**		

	(b) Calculate the lowest energy of an electron confined in a 3-D cubical box of each side 1 Å. **(5)** **OR** **(a)** Explain pair production. Why the pair production phenomenon cannot happen in empty space. **(5)** **(b)** The speed of a bullet of mass 50 g is measured to be 300 m/s with an accuracy of 0.01 %. With what accuracy can we locate the position of the bullet? **(5)**	**10**	**CO4**
SECTION-C **(2Q × 20M = 40 Marks)** • All questions are compulsory, **Q.No. 11** has an internal choice, Each Question carries **20 Marks** • Write long answer/ Derive/ Solve			
Q 10.	(a) Describe the construction and working of a gaseous laser system with proper diagram and label the components used. **(10)** (b) Describe the advantages and disadvantages of an optical fiber over conducting cables. A graded index fiber has a core diameter of 0.05 mm and numerical aperture of 0.02 at a wavelength of 8500 Å. Calculate the normalized frequency and the number of modes guided in the fiber. **(10)**	**20**	**CO1**
Q 11.	**(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. **(10)** **(b)** X-rays with $\lambda = 1$Å are scattered from a carbon bock. The scattered radiation is viewed at 90° to the incident beam. Estimate the Compton shift. Calculate the kinetic energy imparted to the recoiled electron. **(10)** **OR** **(a)** Apply the general wave equation to derive an expression for the Schrodinger's time dependent equation in an operator form. **(10)** **(b)** 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 $\varphi = \frac{E_2\lambda_2-E_1\lambda_1}{(\lambda_1-\lambda_2)}$ **(10)**	**20**	**CO4**

Constant	**Standard Values**
Planck's Constant (h)	6.63×10^{-34} Joule − sec
Permittivity of free space (ε_0)	8.85×10^{-12} Farad/meter
Velocity of light (c)	3×10^{8} m/sec
Boltzmann constant (k_B)	1.38×10^{-23} JK^{-1}
Rest mass of an Electron (m_o)	9.11×10^{-31} kg
Mass of the proton (m_p)	1.67×10^{-27}kg
Charge of an electron (e)	1.6×10^{-19} C