Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, January 2021

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

SECTION A

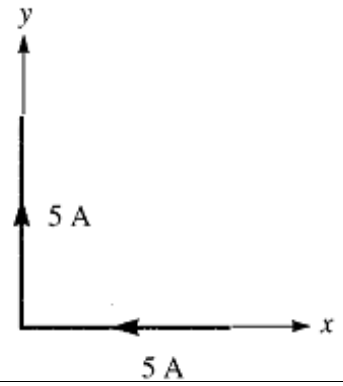
1. **All questions are compulsory. Each Question carry 5 Marks**
2. **Instruction: Complete the statement / Select the correct answer(s)/ Write short answers**

S. No.	Question	CO
Q 1	Express the point P$(-4, 6, 3)$ in cylindrical coordinates (Enter values only)	**CO2**
Q2	The Optical power of 0.5 mW is initially launched into an optical fiber. The power level is found to be 0.0199 mW after 4 km. The attenuation coefficient in this fiber will be _____ dB/km (Enter value only)	**CO1**
Q3	Wite the statement for Faraday's law.	**CO3**
Q4	A "Qubit" can be Implemented by [choose all that apply] a) Photonisation of photon b) polarization of photon c) The energy level of the neutron d) The Energy level of an atom e) rotation of an electron f) spin orientation of an electron	**CO5**
Q5	Select all that satisfy the properties of wave function ψ a) The wave function must be single and finite valued b) The wave function must be discontinuous c) The wave function must be continuous d) The wave function must be differentiable e) The wave function must be infinite	**CO4**
Q6	Explain pair production.	**CO4**

SECTION B

1. **All questions are compulsory. Each question carry 10 marks**
2. **Instruction: Write short / brief notes**

Q 7	Explain the construction of a Ruby laser with a neat diagram. By using the energy level diagram, explain the working of the Ruby laser.	**CO1**
8	Derive the boundary conditions for electric field intensity and electric flux density for the dielectric – dielectric interface.	**CO2**
Q 9	An infinitely long conductor is bent into an L shape as shown in Figure below. If a direct current of 5A flows in the conductor, find the magnetic field intensity at (**a**) $(2, 2, 0)$, (**b**) $(0, -2, 0)$, and (**c**) $(0, 0, 2)$. Take the origin at the bend.	**CO3**

		
Q 10	Prove that particle group velocity is equal to the particle velocity	**CO4**
Q 11	(a) Suppose that $\{\|u_1\rangle, \|u_2\rangle, \|u_3\rangle\}$ is an orthogonal basis for a three dimensional Hilbert's space. A system is in the state given by $$\|\psi\rangle = \frac{1}{\sqrt{5}}\|u_1\rangle - i\sqrt{\frac{7}{15}}\|u_2\rangle + \frac{1}{\sqrt{3}}\|u_3\rangle$$ Determine if this state is normalized [4 marks] (b) Distinguish Classical computers and Quantum Computers. [Minimum 6] [6 marks]	**CO5**
Section C **1. Each Question carries 20 Marks.** **2. Instruction: Write long answers**		
Q12	(a) Derive the time-independent Schrodinger wave equation. [10 marks] (b) Calculate the maximum percentage change in wavelength due to Compton scattering for incident photons of wavelength 1Å and 10Å [10 marks] **OR** (c) Show that the wave function of a particle trapped into a one-dimension box of length L is $\Psi_n(x) = \sqrt{\frac{2}{L}}\sin(\frac{n\pi x}{L})$, where n=1, 2, 3,….. [10 marks] (d) 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 marks]	**CO4**

Values of constants:

Constant	Standard Values
Planck's Constant (h)	$6.63\ x\ 10^{-34} Joule - sec$
Permittivity of free space (ε_0)	$8.854\ x\ 10^{-12}\ Farad/meter$
Velocity of Light (c)	$3\ x\ 10^{8}\ m/sec$
Boltzmann constant (k_B)	$1.38\ \times\ 10^{-23}\ JK^{-1}$
Rest mass of an Electron	$9.11\ x\ 10^{-31}\ Kg$
Charge of electron	$1.6x10^{-19}\ C$