Name: Enrolment No:	

UPES
End Semester Examination, December 2025

Course: Physics for Computer Engineers **Semester: I**
Program: B.Tech. CSE (Batches 1-32) **Time: 03 hrs.**
Course Code: PHYS 1036 **Max. Marks: 100**

Instructions:

- **All questions are compulsory. Section B and Section C have internal choices.**
- **Scientific calculators are allowed.**

SECTION A
(5Qx4M=20Marks)

S. No.	Statement of the Question	Marks	CO
Q 1	What is the principle involved in the propagation of light through an optical fiber? Name the different components of an optical fiber.	**4**	**CO1**
Q 2	Express the point P $(-4, 6, 3)$ in cylindrical coordinates.	**4**	**CO2**
Q 3	Write all the four Maxwell's equations in differential form for time-varying fields.	**4**	**CO3**
Q 4	Calculate the number of photons of wavelength 5500 Å that corresponds to 1.5 J of energy	**4**	**CO4**
Q 5	Differentiate between the Zener and Avalanche breakdown mechanisms in a p-n junction diode.	**4**	**CO5**
	SECTION B **(4Qx10M= 40 Marks)** **There is an internal choice in Question 9.**		
Q 6	Show that the ratio of Einstein's spontaneous to stimulated coefficient is proportional to ν^3, where ν is the transition frequency between both the energy states involved.	**10**	**CO1**
Q 7	Using the continuity equation, demonstrate that the volume change density of a material exhibits exponential decay with time.	**10**	**CO2**
Q 8	Starting from the Biot-Savart's Law, derive an expression for the magnetic field at an arbitrary point due to the current-carrying straight wire of infinite length.	**10**	**CO3**
Q 9	**(a)** The position and momentum of an electron of energy $1.0\,keV$ are simultaneously measured. If the uncertainty in the position of the electron is 1 Å, calculate the percentage uncertainty in the momentum. **(b)** Derive a relation between the phase velocity and group velocity of matter waves. **OR**	**5 + 5**	**CO4**

	(a) Find the maximum kinetic energy of the photoelectrons and the stopping potential if light of wavelength 5890 Å is incident on the metal surface whose threshold wavelength is 7320 Å. **(b)** By applying the uncertainty principle, explain the non-existence of an electron inside an atomic nucleus.		
SECTION-C **(2Qx20M=40 Marks)** **There is an internal choice in Question 11.**			
Q 10	**(a)** Explain Hall effect with a suitable diagram and derive an expression for the Hall coefficient. **(b)** The electron and hole mobilities in a Silicon sample are $0.155\ \mathrm{m^2/V-s}$ and $0.058\ \mathrm{m^2/V-s}$, respectively. Determine the conductivity of intrinsic Silicon at 300 K if the intrinsic carrier concentration is $1.5 \times 10^{16}\ \mathrm{atoms/m^3}$.	**15** **5**	**CO5**
Q 11	**(a)** State the physical significance of the wave function ψ. Solve the time-independent Schrodinger equation for a particle in a 1-D box and derive the normalized wavefunction. **(b)** Calculate the probability of finding the particle in the 1st quarter of the box of size L (between 0 to $L/4$), if it is trapped in a box of size L. Consider that the particle is in the ground state. **OR** **(a)** Pair production and pair annihilation were the first experimental evidence of conversion from energy into mass and back. Using this information, illustrate the phenomenon of pair production and pair annihilation. Justify that the pair production phenomenon cannot happen in an empty space. **(b)** X-ray photon of wavelength 0.3 Å is scattered through an angle of 60° w.r.t. horizontal by a free electron. Find the wavelength of the scattered photon and the recoil energy of the electron.	**15+5**	**CO4**

Standard Physics Constants and their values:

Constants	Standard values
Planck's constant (h)	6.626×10^{-34} Js
Permittivity of free space (ε_0)	8.854×10^{-12} F/m
Velocity of light (c)	3×10^{8} m/s
Boltzmann constant (k_B)	1.38×10^{-23} J/ K
Rest mass of an electron (m_0)	9.11×10^{-31} kg
Charge on electron (e)	1.6×10^{-19} C