Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES
Supplementary Examination, December 2023

Course: Physics I **Semester: I**
Program: SOAE (APE UP) **Time : 03 hrs.**
Course Code: PHYS 1020 **Max. Marks: 100**

Instructions: Use of scientific calculator is allowed.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	An electron has a speed of 1.05×10^4 m/sec within the accuracy of 0.01%. Calculate the uncertainty in the position of the electron.	**4**	**CO3**
Q 2	Explain the phenomenon of double refraction.	**4**	**CO1**
Q 3	Derive the expression for numerical aperture of an optical fibre.	**4**	**CO1**
Q 4	Determine the magnetization and flux density of a diamagnetic material if its magnetic susceptibility is -0.5×10^{-5} and the magnetic field in it is 10^5 Am^{-1}	**4**	**CO2**
Q 5	An electron has a speed of 1.05×10^4 m/sec within the accuracy of 0.01%. Calculate the uncertainty in the position of the electron.	**4**	**CO3**
	SECTION B (4Qx10M= 40 Marks)		
Q 6	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 plank'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**	**CO3**
Q 7	Metastable states have a very important role in the production of Laser light. In the context of population inversion, provide a detailed explanation of the significance of metastable states in the production of laser light. Also discuss different types of pumping mechanisms employed to attain population inversion in different Laser systems. **OR** Show that plane and circularly polarized lights are the special cases of an elliptically polarized light.	**10**	**CO1**

Q 8	Bar magnets are prepared by keeping a ferromagnetic material in magnetic field produced by, say an electromagnet. Even after removing the ferromagnetic material from the magnetic field, the magnetism remains in the material. Discuss in details of the mechanism responsible for this magnetic behavior in such materials (bar magnets). Illustrate this using suitable diagrams. Differentiate between hard and soft magnetic materials and cite some applications.	**10**	**CO2**
Q 9	Deduce the relationship between Einstein's coefficients.	**10**	**CO1**
SECTION-C (2Qx20M=40 Marks)			
Q 10	a. Write short notes on the following: 1. Fill factor 2. Maximum power point 3. Efficiency of a solar cell (10) b. Explain working principle and I-V characteristics of a single crystalline solar cell (10) OR a. Distinguish between crystalline and non-crystalline solids. Define Bravais Lattice and write the names of different Lattices. (10) b. What are Miller indices? Draw the planes (110) and (234). (10)	**20**	**CO4**
Q 11	a. Derive the zero point energy of the particle in its ground state in one dimensional box of length L. (10) b. Derive Schrodinger's time dependent wave equation. (10)	**20**	**CO3**

Constant	Standard Values
Planck's Constant (h)	6.63×10^{-34} Joule-sec
Rest mass of an Electron	9.11×10^{-31} Kg
Permittivity of free space (ε_o)	8.854×10^{-12} Farad/meter
Velocity of Light c	3×10^{8} m/sec
Charge of electron	1.6×10^{-19}C