Name:

Enrolment No:

UPES

End Semester Examination, May 2025

Course: PHYSICS **Semester: II**

Program: B. Tech (Chemical) **Time: 03 hrs.**

Course Code: PHYS 1035 **Max. Marks: 100**

Instructions:

1. *All questions are mandatory in Section A.*
2. *Internal choices are given in questions #9 and #11 of Sections B and C respectively.*
3. *A list of important constants is provided at the end of this question paper.*

SECTION A

(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Enumerate the properties of a well-defined wave function.	**4**	**CO1**
Q 2	Distinguish between diamagnetic, paramagnetic and ferromagnetic materials.	**4**	**CO2**
Q 3	For a simple cubic lattice, determine the ratio of the interplanar spacing for the (121), (011) and the (101) planes.	**4**	**CO2**
Q 4	Mention the different methods to obtain polarized light.	**4**	**CO1**
Q 5	Derive the relation $\boldsymbol{D = \varepsilon_0 E + P}$	**4**	**CO2**

SECTION B

(4Qx10M= 40 Marks)

Q 6	Explain photovoltaic effect. Briefly describe the construction and working of a solar cell.	**10**	**CO4**
Q 7	An element crystalises as fcc monoatomic structure. The density of the element is 11.34 x 10^3kg/m^{3}and the atomic weight is 207.21. Determine its lattice constant and atomic radius.	**10**	**CO2**
Q 8	Two parallel plates having equal and opposite charges are separated by a 2 cm thick slab that has dielectric constant 3. If the electric field inside is 10^6 V/m. Calculate the polarization and displacement vector?	**10**	**CO2**
Q 9	Write all the Maxwell's equation in differential form. Using the equations for a charge free region, obtain the speed of electromagnetic waves in free space. OR Explain the principle, construction and working of Ruby Laser.	**10**	**CO4**

	(2Qx20M=40 Marks)		
Q 10	a) Deduce Bragg's law for X-ray diffraction. Elaborate the XRD technique for sample analysis. b) α- Iron has a bcc structure. X rays of wavelength 1.65 Å diffracted from the (110) plane is detected at an angle 2θ = 36.2°. Determine the lattice parameter and the density of α-Iron if the molecular weight is 55.84g/mol.	**10** **10**	**CO3**
Q 11	a) High energy photons get scattered from free electrons in heavy Z material. Obtain expression for wavelength shift. b) Show that the ratio of Compton wavelength to de Broglie wavelength is expressed as $\frac{\lambda_c}{\lambda_d} = \frac{\beta}{\sqrt{1-\beta^2}}$ Where β= v/c OR a) Explain the phenomena of photoelectric effect. Show that the observations of the phenomena cannot be explained by wave theory of light. b) 1mW of light of wavelength 4560Å is incident on a Cesium (Cs) surface. Calculate the photo-electric current liberated, assuming quantum efficiency of 0.5%. Given: work function of Cesium (Cs) = 1.93 eV	**10** **10** **10** **10**	**CO3** **CO3** **CO3** **CO3**

Planck's constant, h = 6.6 x 10^{-34} J.s
Boltzmann's constant, k = 1.38 x 10^{-23} J/K
Mass of electron, m_e = 9.1 x 10^{-31} Kg
Charge on an electron, e = 1.6 x 10^{-19} C
Mass of proton, m_p = 1.67 x 10^{-27} Kg
Speed of light, c = 3 x 10^8 m/s
Rydberg Constant, R = 1.097 x 10^7 m-1
Avogadro's number = 6.023 x 10^{23}
Permeability of free space, μ_o= 4π x 10^{-7} Henry/m
Permittivity of free space, ε_o = 8.85 x 10^{-12} F/m