



Name:

Enrolment No:

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**Supplementary Examination Dec 2021 and Jan 2022**

**Course: Physics I**  
**Program: B.Tech. APE+UP, R & SEE, E&CE, EE, ASE**  
**Course code: PHYS1020**

**Semester: I**  
**Time 03 hrs.**  
**Max. Marks: 100**

**SECTION A**

- 1. Each Question will carry 4 Marks**
- 2. Instruction: Complete the statement / Select the correct answer(s)**

S. No.	Question	CO
Q 1	In a two slit interference pattern at a point we observe 10 <sup>th</sup> order maximum for $\lambda = 7000\text{\AA}$ . What order will be visible here if the source of light is replaced by light of wavelength 5000 $\text{\AA}$ .	CO1
Q2	If the earth receives 2 Cal min <sup>-1</sup> cm <sup>-2</sup> solar energy, what are the amplitudes of electric and magnetic field of radiation?	CO2
Q3	Derive the relationship between phase velocity and group velocity for matter waves.	CO3
Q4	Light of wavelength 200 nm falls on a photosensitive material having work function 4.2 eV. What is the Kinetic energy of the slowest and fastest photoelectron?	CO3
Q5	Draw the planes $[1\bar{2}1]$ and $[234]$	CO4

**SECTION B**

- 1. Each question will carry 10marks**
- 2. Instruction: Write short / brief notes**

Q 6	Discuss the construction and working of He-Ne LASER.	CO1
Q 7	Explain the hysteresis phenomenon for ferromagnetic materials.	CO2
Q 8	Using Maxwell's equations in differential form obtain the equation of em wave in free space in charge free region and hence show that electromagnetic waves are transverse in nature.	CO2
Q.9	Discuss the functioning of a solar cell based on an illuminated PN junction diode. Also, describe its IV characteristic.  Or Copper has fcc structure and the atomic radius is 1.278 $\text{\AA}$ . Calculate the density of Cu crystal. Given that atomic weight of Cu = 63.5.	CO4

**Section C**

- 1. Each Question carries 20Marks.**  
**2. Instruction: Write long answer.**

Q10	<p>a) Derive the expression for the Eigenvalue and Eigen vector of a particle, trapped in a one-dimensional rigid box of length L. Plot the probability curve and the energy eigen value.</p> <p>b) Calculate the energy difference between the ground state and the second excited state of an electron, trapped in a one-dimensional box of length <math>10^{-8}</math> cm.</p> <p style="text-align: center;">OR</p> <p>a) Write the momentum conservation equation for scattering of an electron by a X-ray photon, hence derive the relation between angles of scattering of outgoing electron and modified photon.</p> <p>b) A proton is confine to a nucleus of radius <math>5 \times 10^{-15}</math>m. Calculate the minimum uncertainty in its momentum. Also, calculate the minimum kinetic energy of the proton. Hence, show that the presence of proton in the nucleus is permitted</p>	<b>CO3</b>
Q.11	<p>(a)Deduce the Clausius- Mossotti equation for dielectric material.</p> <p>(b) The atomic weight and density of Sulphur are 32 and <math>2.08 \text{ gm/cm}^3</math> respectively. The electronic polarizability of atom is <math>3.28 \times 10^{-40} \text{ F-m}^2</math>. If a Sulphur solid has cubic symmetry, what will be its relative permittivity.</p>	<b>CO2</b>

List of important Constants

Planck's constant,  $h = 6.6 \times 10^{-34} \text{ J.s}$   
 Boltzmann's constant,  $k = 1.38 \times 10^{-23} \text{ J/K}$   
 Mass of electron,  $m_e = 9.1 \times 10^{-31} \text{ Kg}$   
 Mass of proton,  $m_p = 1.67 \times 10^{-27} \text{ Kg}$   
 Velocity of light,  $c = 3 \times 10^8 \text{ m/s}$   
 Rydberg Constant,  $R = 1.097 \times 10^7 \text{ m}^{-1}$   
 Avogadro's number =  $6.023 \times 10^{23}$   
 Permeability of free space,  $\mu_0 = 4\pi \times 10^{-7} \text{ Henry/m}$   
 Permittivity of free space,  $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$   
 Impedance of em wave in free space  $Z_0 = 377 \text{ Ohm}$