


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, December 2022			
Course: Physics Program: B. Tech APE-UP, ADE, Chemical, ME, Mech, ECE, CE, E&Com, SE, ASE Course Code: PHYS 1002		Semester: I Time : 03 hrs. Max. Marks: 100	
Instructions: Use of scientific calculator is permitted.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Differentiate between soft and hard magnetic materials.	4	CO2
Q 2	Draw the atomic planes described by the miller indices (123) and (112).	4	CO4
Q 3	A signal of power $5\mu\text{W}$ exists just inside the entrance of 0.1 km long fibre. Calculate the attenuation coefficient of the fibre if the power inside the fibre be $1\mu\text{W}$.	4	CO1
Q 4	State the characteristics of Laser. Also list their applications.	4	CO1
Q 5	If the magnitude of \vec{H} in a plane wave is A/m , find the magnitude of \vec{E} for plane wave in free space.	4	CO2
SECTION B (4Qx10M= 40 Marks)			
Q 6	Show that plane and circularly polarized lights are the special cases of an elliptically polarized light.	10	CO1
Q 7	An electron is trapped in a 1D infinitely deep potential well of width $L = 10^{-9}$ m. Calculate the wavelength of photon emitted from the transition $E_4 \rightarrow E_3$.	10	CO3
Q 8	Derive the expression for Clausius Mossotti equation.	10	CO 2
Q 9	Derive the mathematical expression for Ampere's circuital law incorporating Maxwells correction. OR If the earth receives $2\text{ cal min}^{-1}\text{cm}^{-2}$ solar energy, what would be the amplitudes of electric and magnetic fields of radiation	10	CO2
SECTION-C (2Qx20M=40 Marks)			

Q 10	<p>a. What is pair production? Explain why it cannot take place in an empty space. (10)</p> <p>b. Develop the time dependent Schrodinger wave equation for a quantum particle starting with simple wave equation. (10)</p> <p style="text-align: center;">OR</p> <p>a. What is the photoelectric effect? Explain it with the help of different graphs. (10)</p> <p>b. A photon of energy E is scattered by an electron initially at rest (rest mass energy, E_0) (Compton scattering problem). Show that the maximum kinetic energy (KE_{max}) of the recoil electron can be calculated as</p> $KE_{max} = \frac{2E^2/E_0}{1+2E/E_0} \quad (10)$	20	CO3
Q 11	<p>a. Define Bravais lattice and describe their different types. (10)</p> <p>b. Define maximum power point, fill factor & efficiency of a solar cell. Calculate input power to obtain 0.1 watt output power from 10% efficient poly-Si solar cell. (10)</p>	20	CO4

LIST OF IMPORTANT CONSTANTS

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