


Name:			
Enrolment No:			
<b>UNIVERSITY OF PETROLEUM AND ENERGY STUDIES</b> <b>End Semester Examination, December 2022</b>			
<b>Course: Physics</b> <b>Program: B. Tech APE-UP, ADE, Chemical, ME, Mech, ECE, CE, E&amp;Com, SE, ASE</b> <b>Course Code: PHYS 1002</b>		<b>Semester: I</b> <b>Time : 03 hrs.</b> <b>Max. Marks: 100</b>	
<b>Instructions: Use of scientific calculator is permitted.</b>			
<b>SECTION A</b> <b>(5Qx4M=20Marks)</b>			
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 $A/\text{m}$ , find the magnitude of $\vec{E}$ for plane wave in free space.	4	CO2
<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
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
<b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b>			

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 <math>E</math> is scattered by an electron initially at rest (rest mass energy, <math>E_0</math>) (Compton scattering problem). Show that the maximum kinetic energy (<math>KE_{max}</math>) of the recoil electron can be calculated as</p> $KE_{max} = \frac{2E^2/E_0}{1+2E/E_0} \quad (10)$	<b>20</b>	<b>CO3</b>
Q 11	<p>a. Define Bravais lattice and describe their different types. (10)</p> <p>b. Define maximum power point, fill factor &amp; efficiency of a solar cell. Calculate input power to obtain 0.1 watt output power from 10% efficient poly-Si solar cell. (10)</p>	<b>20</b>	<b>CO4</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 $Z_0 = 377 \text{ Ohm}$
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