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Total Pages : 3

Roll No.

PHY-552

Electromagnetic Theory and Spectroscopy

M.Sc. Physics (MSCPHY)

2nd Year Examination, 2022 (June)

Time : 2 Hours]

Max. Marks : 80

Note : This paper is of Eighty (80) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A

(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Twenty (20) marks each. Learners are required to answer any Two (02) questions only.

(2×20=40)

1. State Maxwell's equations and explain their boundary conditions in detail. State and prove Poynting vector theorem.

2. Derive the expression for Lande's splitting g-factor and explain it with help the of Zeeman effect of sodium doublet components D_1 and D_2 .
3. Discuss the retarded potentials. Calculate the retarded potential of an infinite straight filamentary current.
4. What is Raman effect? Discuss how the change in polarizability leads to appearance of Stoke's and Anti-Stoke's line. In what way does it differ from the infrared spectra?
5. Determine the boundary conditions satisfied by B, H and E, D at the interface between two media of different permeability and dielectric constant.

SECTION-B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Ten (10) marks each. Learners are required to answer any Four (04) questions only. ($4 \times 10 = 40$)

1. Derive continuity equation, starting from Maxwell's equation.
2. Write an expression for energy of a harmonic oscillator and explain zero point energy.
3. Explain the reflection and transmission at oblique incident using suitable expression.

4. The ground state of chlorine atom is $^3P_{3/2}$. Find its magnetic moment. Into how many substates will the ground state split in a weak magnetic field?
 5. What is gauge transformation? Define the conditions for Coulomb and Lorentz gauge.
 6. Draw a schematic diagram to represent the energy levels of a diatomic molecule regarded as an anharmonic oscillator and show the allowed transitions and expected spectrum.
 7. Calculate the work done in assembling a charge sphere of radius R.
 8. A plane monochromatic plane polarized E-M wave is travelling eastward. The wave is polarized with E direction vertically up and down alternatively. Calculate E, B and S provided that the amplitude of the electric field strength is 0.05 V/m and frequency 6 MHz.
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