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PHY-552

Electromagnetic Theory and Spectroscopy

M.Sc. PHYSICS (MSCPHY-12/13/16/17)

Second Year, Examination 2021 (Winter)

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 x 20 = 40]

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

P.T.O.

Q.2. Explain the magnetic dipole radiation. Derive equation for ratio of magnetic to electric power.

Q.3. Describe and explain the electronic spectrum of a diatomic molecule. What is Born-Oppenheimer approximation?

Q.4. Explain infra red spectroscopy. Discuss fundamental vibration of polyatomic molecule with suitable example.

Q.5. Explain the scattering of electromagnetic radiation and give the scattering parameters.

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 x 10 = 40]

Q.1. Calculate the work done in assembling a charge sphere of radius R.

Q.2. In an experiment a 1MeV proton moves in a uniform magnetic field in a circular path. What energy must an alpha particle have if it is to circulate in the same orbit?

Q.3. An electron in an atom orbits the nucleus and possesses orbital dipole moment. Derive an expression for connecting this magnetic moment with the orbital angular momentum of the electron.

Q.4. Explain the reflection and transmission at oblique incident using suitable expression.

Q.5. Obtain the expression for Lande's 'g' factor in L-S and J-J coupling scheme. Calculate the Lande's 'g' factor and total magnetic moments of atoms in the states $^2D_{3/2}$, $^3D_{5/2}$ and $^2F_{7/2}$.

Q.6. In the infra-red spectrum of HCI molecule, the first line falls at 20.8 cm^{-1}. Calculate the moment of inertia, reduced mass and the bond length of molecule.

P.T.O.

Q.7. Distinguish between dissociation energies D_e and D_o.

Q.8. A substance shows Raman line at 4567Å when exciting line 4358 Å is used. Deduce the position of Stokes and antistokes lines for the same substance when the excited line 4047Å is used.

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